Nature Magazine

VOLUME 46 NUMBER 4

APRIL, 1953

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Nature in Print

By HOWARD ZAHNISER

FOR some time a review copy of a book by a Soviet naturalist-writer has been at hand — Mikhail Prishvin's *The Lake and the Woods, or Nature's Calendar.*

In the tense atmosphere in which we are living, how does one discuss such a book; how commend and recommend it for reading by others?

Pondering this question, I took the volume with me on a January railway journey. As I laid it aside, and, after browsing through it in the train, took up the magazine section of that Sunday's *New York Times*, January 25th's, I came upon an article on Tucson, Arizona, by the editor and publisher of that city's *Arizona Daily Star*, William R. Mathews. There I read that "if. . . Tucson provides accurate readings for the climate of American public opinion, there is still — beneath a surface belligerence — a deep and latent urge in the hearts of the American people which would surely respond to a convincing attempt in behalf of honorable peace with the Soviet Union." Mr. Mathews said further, "The time has come to take the initiative, it seems to me, in making such an approach." He pointed out that, "We do not appreciate, for example, the Russians' real suspicion and fear of us when they see us building a ring of bases stretching from Iceland, Britain, North Africa, Cyprus, and Saudi Arabia to the Philippines and Okinawa. We cannot see," he continued, "that we might feel the same way if the Russians had air bases in Iceland, North Africa, the Azores, Guam, and Hawaii." As immediate things to be done in preparation for negotiations Mr. Mathews made two suggestions. First, he said that "President Eisenhower and Premier Stalin must devise some effective way of communicating with each other," and then, he emphasized: "A better understanding between the two peoples themselves must somehow be cultivated. Something must definitely be done to moderate suspicions."

Reading this counsel from the Tucson editor, I began to surmise that perhaps it was a timely privilege to have at hand a work by a Soviet naturalist that might well be enjoyed and valued by my own fellow countrymen who appreciate the outdoors. I looked in the book for the New York publisher's press release, not so much to see again the dictum that "Prishvin is no doubt the most gifted writer now living in the Soviet Union," but rather to note how the release commented that our 78-year-old author "has managed to survive the purges, probably because, as a naturalist, his themes are unpolitical: Russia's landscapes, its animals, birds, and plants." My eye went on to note the commendation of Professor Ernest J. Simmons, of Columbia University's Department of Slavic Languages, who called Prishvin "a kind of Russian W. H. Hudson" and "a poet of nature" and expressed the opinion that, "All lovers of the outdoors will appreciate the narrative charm and the wonderful insights into the mysteries of nature in *The Lake and the Woods*." And I saw Brooks Atkinson quoted: "Prishvin knows nature just as intimately if not more intimately than Hudson did, but he also understands human beings as thoroughly as birds and animals. There is enormous relish all the way through — humor and lyricism as well as deep and subtle knowledge. I have never read anything about dogs so sensitive, so sympathetic, and yet so hard-headed. Nothing as wholesome, genial, humane, and discerning as this has come out of Russia for many years." So Mr. Atkinson commended this book. And, as I seemed in my own reflections to be agreeing with these praises, there came to me a satisfying joy of some sort in sensing the possibility of thus noting one avenue that might lead, as Mr. Mathews had written, to "a better understanding between the two peoples."

An hour or so later, as I lounged briefly in a New York waiting room, I picked up a copy, which someone else had left, of *The New Yorker* (for January 24) and there on the first page in "The Talk of the Town" at a glance picked out the sentence: "To Mr. Stalin and his crowd, the rock and the rain are just as indispensable as they are to President Eisenhower and our crowd." How curious to me, a lover of rock and rain myself, to see such comment there — and to read on that "what both sides will have to do is come off their high horse, quit pretending that a man is bigger than a bayberry bush." The jolly and deeply wise bit of talk of which this was a part, I found, was a comment on coronations and inaugurations as "preposterous backdrops for Man's present adventure in nature." Its writer, imagining himself inaugurated as President of the United States, envisioned a firm refusal to spend his first day in office indoors. "When they tried to catch us at a desk," said these brave words, "we would shake our head and issue a statement: 'Sorry, got to go out today. Got to call on a bayberry bush, got to see a pond about a man; got to find spruce gum, look under a rock, test rain for wetness and fertility; got to look for Life Everlasting.' " And as I pondered this humor and wisdom it seemed further that Mikhail Prishvin's *The Lake and the Woods* might indeed be a text for a timely sermon.

What this sermon might be I shall not suggest any further, but be content with relating a little more about the text, the book itself. Its scene is what the book's jacket note calls "the still unspoilt country around Lake Pleshcheyevo, in the Moscow district." As this note says further, "With the author, one of Russia's foremost nature writers, we see the ice-bound lake region thaw and revive in spring, and watch the life of birds and beasts throughout the seasons. We share in expeditions, in village feasts, in fishing and hunting, and meet his dogs, portrayed in unforgettable character studies. . . . There is a constant glow of warmth, affection, and enthusiasm."

The volume itself, we see, is comprised of some seven dozen and more independent items — varying from vignettes of only a few lines to longer sketches, descriptions, accounts, or narratives, some as long as seven or eight pages — all grouped seasonally, the spring arrangements being uniquely in four sections: "Spring," "The Spring of Green Growing Things," "The Spring of the Woods," and "The Spring of Man." And throughout the volume are the stark and sensitive, bold and beautiful wood engravings by Brian Hope-Taylor which seem appropriate to this exotic book that yet deals so fundamentally with the things of Nature as to seem of common interest to us as well as the countrymen of its author.

Mikhail Prishvin is a man who, like ourselves, can confess, "I like nature — I have a passionate feeling for nature, but that by no means prevents me from liking a fine, handsome town, with its activity and its life." He is a man who can quote with sym-

Lovely and Laughing

By RUTH SEYMOUR VESELY

With ink to match the woodland violet
And quill the color of a bluebird's wing
I started to compose a triolet
To Spring.

But pastel fruit-trees sang, "Look up"
And valley-lilies chimed, "Look down,"
A bee explored a tulip cup,
And every jonquil grew a gown
Of golden silk, and in a pool
Three linnets splattered — tiny birds
As gay as children after school. . .
How capture Spring with metred words?

Despairingly I threw my verse away,
Tearing the paper, tossing fragments high
And such was the enchantment of the day
Each piece became a living butterfly!

pathy the young man who announces, "I want to find a spot where up to now the foot of man has never trod." Yet he knows the poignant modern experience of thinking in a secluded spot, "After all, the forest is big enough; there must be miles of it where no one has ever trodden," and then, alas, having "your eyes stray around and light on a broken egg-shell," as shocking, apparently, to him in its evidence of man as a colored paper wrapper is to us. Like many an American he considers his "feeling of complete freedom in the woods" as the "main reason for hunting." He has no liking to go about the forest in a gang but rather confides: "I like to walk slowly, with many halts to stand and stare, then all the small beasts take me for one of themselves; I like to watch all these living creatures and wonder, only killing when I must."

"How true it is," he says in another sketch, "that you can spend all your life in the woods, observing and studying everything, yet something suddenly occurs and you realize you know nothing." He writes of "feeling the life of nature as a whole" and declares that, "We are akin to the whole wide world." He sees that "the majority of animals and plants are very closely connected with the life of man," and he contemplates the "new approach to the solution of political problems via the study of biology."

Thus he shares with many of us Americans our modern experiences in a civilized living with a deepening appreciation of the importance of the world of Nature. He writes of "people of all countries. . . brought together" by the scientific work of bird banding, but in his facing as we all must the fundamentals of our living he suggests even stronger ties that will surely bind all mankind together, when men have learned through such naturalists and their own direct experiences their own true natures and how indispensable are "the rock and the rain" to all.

The Lake and the Woods is notable not only for its accounts of Nature, but also for its tales of dogs and its yarns that characterize people. It is a full rich book by an outdoorsman. "I know quite well," he confesses, "that there is much poverty in the world, and that sometimes it seems almost inhuman to speak of the joy of life," yet he perceives how well we might meet human need "if only we could somehow describe our joy with greater care." And with great care he does himself describe his joy.

There is much beauty in this book, in its subjects revealed and in its expression, but perhaps no joy in beauty that surpasses that of spring following the deep winter which this Soviet naturalist has known. What a joy we feel as we hear his child shout, "Look, the land is showing," and hear Mikhail Prishvin's comment: "It seemed as if somebody had been running hard after spring, and at last had caught up with her and touched her, and spring stopped and stood there lost in thought. The cocks were crowing all round, and the blue woods began to show up through the mist." Or what expression of faith in the promise of spring is more poignant than these words written of an occasion when he had stayed out all night, and:

"Towards dawn there was a very severe frost; I was completely benumbed by the cold and walked about all the following day like someone in a trance. Late in the evening I started to shiver, and spent the next day in bed, feeling as if I were completely detached from the fight my body was making with life and death. At dawn on the third day I dreamed I saw the many-coloured shore of Lake Pleshcheyevo and the white gulls riding on the ice in the blue water, and how many other lovely things would still be there for me; I shall even yet see the lake completely free from ice and the earth covered with green growing things; I shall greet the silver birches in their spring dresses, and hear the first rustle of the green leaves."

The Lake and the Woods, or Nature's Calendar. By Mikhail Prishvin. Translated by W. L. Goodman. Pantheon Books, 333 Sixth Avenue, New York 14, N.Y. 1952. 258 pp. (6 by 9½ in.), with 25 wood engravings by Brian Hope-Taylor. $4.50.

Children and Nature

Exploring Nature with Your Child. By Dorothy Edwards Shuttlesworth. New York. 1952. Greystone Press. 448 pages. Illustrated. $3.95.

"Children are natural explorers," says the author, who is editor of *Junior Natural History Magazine* of the American Museum of Natural History. Nature is one of the most fertile and frequent fields of exploration, and one that poses many questions that the wise parent will strive to answer. With the aid of this book the parent can become an informed and helpful co-explorer with the child. In fact, there is no doubt that many parents, whose youthful explorations of Nature were thwarted, will find delayed pleasure in the doors that this book opens to them. This is not an identification text, or does it follow any particular organized plan that might place it in the category of "study." Instead it supplies a wealth of suggestion as to the directions in which exploration may be channeled, and a wealth of fascinating information that will stimulate the child to a desire for wider and wider knowledge.

In the Vivarium

Vivarium Life. By Alfred Leutscher. London, England. 1952. Cleaver-Hume Press, Ltd. 230 pages. Illustrated. $2.00.

This is a book providing practical information on the care of amphibians, reptiles and cold-water fishes in the vivarium. It is of special interest to herpetologists, biologists and teachers.

NATURE MAGAZINE

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To Stimulate Public Interest in Every Phase of Nature and the Out-Of-Doors, and Devoted to the Practical Conservation of the Great Natural Resources of America

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Earth's Riches

Riches from the Earth. By Carroll Lane Fenton and Mildred Adams Fenton. New York. 1953. John Day Company. 159 pages. Illustrations by the authors. $2.75.

In this introductory book to the earth materials that are so essential to man's existence, this team of naturalist-writers provide another valuable book in their growing list of publications. From aluminum to zinc, they describe both rare and common rocks, minerals and ores, some of which date back to ancient times, while others are of recent discovery and newfound value. This book is written for the absolute layman and for the school student, and opens a first door to the knowledge of geology and its importance.

South Florida Plants

400 Plants of South Florida. By Julia F. Morton and R. Bruce Ledin. Coral Gables 34, Fla. 1953. Text House. 134 pages. 28 drawings by Frank D. Venning. $3.50.

More than four hundred trees, shrubs, vines and herbaceous plants found in south Florida are described in this book, which will answer the frequent query by visitors — "What kind of a plant is that?" South Florida is rich in varied flora, some native, much exotic. Florida gardens are a delight to even the most casual flower enthusiast. Information about this flora has been scattered through various books, but here, for the first time, it is assembled in one place. The descriptions are brief and popular, and should serve readily for identification. We know that we wish we had had this book handy when we were in south Florida about a year ago, and when we encountered a number of trees and shrubs for which we could find no positive identification easily at hand.

Being A Mother

The Complete Book of Mothercraft. New York. 1953. Greystone Press. 896 pages. Illustrated. $4.95.

Between the covers of this valuable and useful book has been collected expert advice by twenty-five leading specialists. They cover first the expectant mother, and then provide counsel on baby and small child care right through adolescence. There is even a section on choosing a name for the baby, together with the meaning of names. Such subjects as indoor entertainment of the child, what to do in emergencies, how to meet the problem of a "dawdler," diseases of childhood, and many others are included. An excellent index makes this an easy reference work for the parent, who can find just about any answer to parental problems in this volume.

Magic of Camping

Summer Magic. By Kenneth and Susan Webb. New York. 1953. Association Press. 159 pages. $2.50.

Both of these authors are directors of summer camps for young campers, and, if we may judge by this book, eminently successful because of their deep understanding of the camping experience and its values to growing boys and girls. This is a book that should be read by any parent who is considering sending a girl or boy to a summer camp. The parent will not only find in the writings of the Webbs a real appreciation of camp values, but sound guidance in the selection of a proper camp for the youngster.

Everglades Birds

Everglades Birds. By Henry H. Collins, Jr. New York. 1953. Blue Heron Press, Box 236, Bronxville, N.Y. 16 pages. Illustrated in color and black and white by Roger Tory Peterson. Twenty-five cents.

This is the latest in this series of wildlife booklets by Mr. Collins. The objective is to provide handy material for visitors to National Park and other areas. These are introductory, only, and contain brief descriptions of those birds most likely to be seen. A check list of birds of southern Florida is provided.

In the Arctic

Arctic Solitudes. By Admiral Lord Mountevans. New York. 1953. The Philosophical Library. 143 pages. Illustrated. $4.50.

The name of the author of this book has been long connected with Arctic exploration, and he served as second in command of Scott's last expedition. In this book he gives a concise history of expeditions that have ventured in search of the Northeast and Northwest Passages and of the North Pole.

Bird Migrants

Bird Migrants. By Eric Simms. London, England. 1952. Cleaver-Hume Press, Ltd. 212 pages with photographs by Eric Hosking. $2.00.

Migration of birds has been noted since the days of ancient Greece, when the movement of birds brought about various theories with respect to this mystery of Nature. In this immediate volume a British ornithologist reviews some aspects of bird migration in the light of more recent studies and with respect to birds of Britain and the Continent. It is of special interest to bird students.

F. and W. News

Clayton B. Seagears, Director of Conservation Education of the New York Conservation Department, drew the winning design for the 1953-54 Migratory Bird Hunting Stamp, or duck stamp, according to Fish and Wildlife Service announcement. The subject is a blue-winged teal in flight over bulrushes. There were 53 contestants in this year's contest. . .An indication of the gunning pressure on our wildlife resources is provided by the new high record for hunting licenses sold during the fiscal year ending June 30, 1952. Sales totalled 13,902,428, topping the previous record of 1949 by about 150,000. Most licenses were sold in Pennsylvania, with Michigan a close second, and New York in third place. . . Once almost wiped out by whaling operations, the gray whales, with protection, have increased so that they are numbered in the thousands. The annual southward migration of these mammals along the coast of California has been under study by Dr. Raymond M. Gilmore of the Fish and Wildlife Service, who will follow the whales to their wintering waters. . .There were 17,127,896 fishing licenses sold during the fiscal year ending June 30, 1952. This was a new high, and Michigan, California and Wisconsin, in the order named, sold the most licenses.

School of Fishing

We had never thought about anybody going to school to learn how to fish until we visited Sarasota, Florida, and encountered the piscatorial educational facilities offered by Ross F. Black and known as Blacky's Fishing School. Now Blacky sends us a copy of his booklet entitled "How to Fish with Lures," a treatise applying to salt and fresh water fishing alike. If you would like to know more about this interesting educational activity drop a line to Ross F. Black, P.O. Box 498, Sarasota, Florida.

Bird Recording

Using a micro-groove record, Jerry and Norma Stillwell, Texas ornithologists, have been able to put on one disc 135 distinctive songs and calls of 49 different species of birds. The result is a recording that provides forty-five minutes of songs, with interesting commentary. Listening to this record makes one realize the amount of time and infinite patience required to prepare this long-playing record, which is heartily endorsed both by the American Nature Association and the National Audubon Society. This record is priced at $7.95.

Products

Leitch Engineering Co., Manchester, N.H., has developed what it calls the "Sportshack." It is a seven-by-seven-foot portable house that weighs about two hundred pounds, can be carried on an automobile top, and will serve as a cabin in the wild. At home it is a utility shed or a playhouse for the kids. . .Hoffco Inc., Richmond, Indiana, has developed a new chain saw that is called "Sawette." It is reputed to supply the answer to one-man chain saw operation. . .United Products Company, 9043 South Western Ave., Chicago 20, Illinois, announces a pocket-size, light-weight binocular that it calls "Titan Powered Midget." We have not seen the instrument, which is a ten-power glass, but it sounds like something worthy of investigation by anyone looking for a modest-priced glass.

Contents Noted

PENDING before the 83rd Congress is a bill known as the Baker Bill, H.R. 1972. This is the new version of the Tackett Bill, which received favorable notice during the 82nd Congress but not final action. Under the bill ten percent of the revenues from the National Forests would be set aside for recreational development and wildlife habitat improvement within the forests. A ceiling of five and one-half million dollars is placed on the amount to be expended annually, and none of the money may be used for land acquisition. Recreational use of the National Forests has increased steadily, but the funds available have been entirely inadequate to provide even minimum recreational facilities. Sanitary conditions are poor, often dangerous. There should be some definite program to provide continued support for the proper conduct of this phase of National Forest use. It can most logically be accomplished in the orderly fashion provided in the Baker Bill. Hearing of the arguments, pro and con, on this measure were set for March 11 (after we will have gone to press), and it is hoped that members of the American Nature Association will let their Congressman know how they feel about such a sound and practical piece of legislation.

OTHER legislation of constructive character in the conservation field includes H.R. 210, extending protection of our national bird, the Bald Eagle, to Alaska. Although the bounty on the bird has been removed in the Territory, the eagle is not protected. Congressman Wickersham of Oklahoma has introduced H.R. 195 to establish a temporary commission to investigate the costs of upland watershed control, and to compare the cost of that kind of program with the cost of the large reservoir program recommended by the Army Engineers. This is designed to meet the problem of soil erosion and waste, as well as stream pollution due to runoff of silt, by going back to the basic watershed to improve conditions. Congressman Ostertag of New York, in H.R. 1405, directs the Army Engineers to restudy and reevaluate rivers-and-harbors and flood-control projects in the light of changing conditions and the passage of time. Some of these projects were approved at least ten years ago. Congressman Poage of Texas, through H.R. 559, also seeks to activate a flood control program through basic work on the watersheds. Under S. 783, proposed by Senator Anderson of New Mexico, it is sought to prevent the abuses of National Forest areas through questionable mining claims, as described in the February, 1953, issue of *Nature Magazine*.

TWO measures calculated to provide a better check on Bureau of Reclamation projects have been filed. Congressman Scudder of California proposes, in H.R. 1842, to require surveys of cost and economic feasability of new projects to be reported first to the State or States affected for their comment, and to the President. After all reports and comments have been reviewed by Congress, the Bureau's program would have to be approved by Congress before the Secretary of the Interior could act. Congressman Saylor of Pennsylvania, in H.R. 2220, seeks closer supervision and better methods of estimating the costs of irrigation and reclamation projects, and review of projects in which increased costs arise. In the past no few reclamation projects have increased tremendously in price over original estimates. Such increases have stretched the liquidation possibilities of the programs to a point where economic justification no longer has any part. Review of the many and expensive projects is plain common sense, and the Congress appears convinced that it is necessary.

QUITE a furor has been stirred up in California as a result of the desire of Mrs. Belle Benchley, director of the San Diego Zoo, to capture alive a breeding pair of California condors and offer them the hospitality of zoo's giant bird cage in which to raise progeny. The State of California gave the go-ahead signal and Lewis Wayne Walker is now stalking the condors. However, the Audubon Society and the Sierra Club have risen in opposition, and the Cooper Ornithological Society seems to be split down the middle, pro and con. Mrs. Benchley contends that raising the birds in captivity would assure preservation of the species and provide specimens for other zoos, and that poachers are shooting the birds anyway. Opponents of the idea contend that the few remaining condors should be left in the wild area that has been declared a condor refuge, and where there may not be more than ten nesting pairs of the birds. Even though we know that a pair of condors in Mrs. Benchley's and Mr. Walker's care would receive the utmost solicitude, we are inclined to favor leaving the birds in a state of Nature.

THERE are sadistic overtones to a crow-killing orgy near Asa, Texas, that rather sickens us. It is reported that Joe Browder of Greenville, Texas, hates crows. So he fashioned 300 bombs, using 150 pounds of dynamite in the process. When the birds congregated in their rookery for the night, the bombs, tied in the trees, were exploded simultaneously. Estimates were that 50,000 crows were thus killed or wounded. Asa citizenry rushed in with clubs and finished off the wounded birds on the ground. This is said to have been Browder's twenty-third mission to bomb crows. While excessive populations of crows do often have to be controlled for economic reasons, studies of crow diet of insects and for feeding the young show these black birds to be valuable allies of man. In any event, we do not believe that any such drive on crows is justified just because someone happens to hate crows and to revel in mass destruction. R.W.W.

It was not the usual chatter of the chickaree, or pine squirrel. Instead, it was unbroken, unvaried and always on the same high, screaming key—*chic-chic-chic, ka-chic-chic-chic.*

When A HunterStrikes

By JOHN LINDSEY BLACKFORD

Photographs by the Author

The winged huntress swung away to the great tamaracks on the hill.

Ka-chic-a-chic, ka-chic-chic-chic-chic — so high-pitched and endless was the excited scolding of the pine squirrel that I finally stirred from my comfortable seat on a rotten log and reluctantly went to investigate. This latest broadcast by that furry little forest alarmist had been going on so long that now other wood voices were stilled. He might merely be denouncing my intrusion, although I was hidden in dense leafy under cover several log-lengths away. Yet it was not his usual chatter. Instead, it was unbroken, unvaried, and always on the same high, screaming key — *chic-chic-chic, ka-chic-chic-chic.*

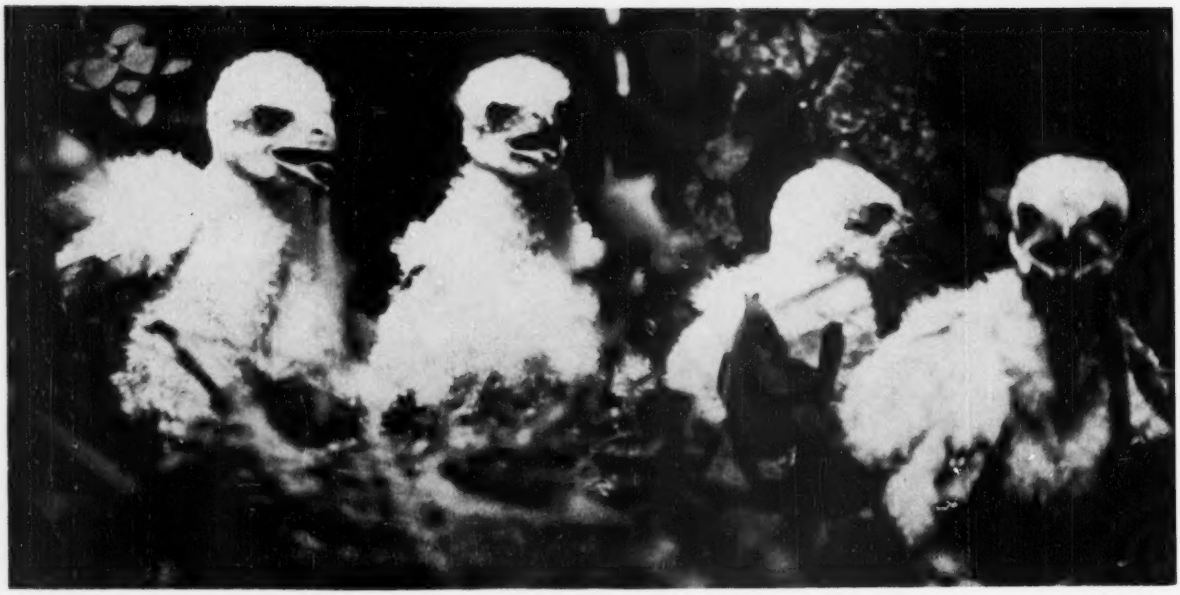
The slashing sweep of wide banking wings through sunlit tree-trunks ahead swept all doubt away. A big blue darter, one of the accipiters, or true bird hawks, was striking repeatedly with deadly accuracy at the chickaree. Bark-scales showered from the bole of a half-grown yellow pine as the squirrel swirled around the conifer among bare branch stubs forty to sixty feet up. It was protection gained from these long, dead limbs, plentifully spiking the trunk at that height, that gave the alert little tree dweller opportunity to twist and dodge successfully just when he seemed within the talons of the attacker. The latter, a female Cooper's hawk flashing the broad, three-foot wing-spread of her sex, and next to the goshawks in size among the accipiters, was thereby greatly hampered in her plunging flights. Yet those broad, blunt-tipped wings were fashioned for forest tangles. And it was amazing with what speed and skill she swung in among the branches, almost to clutch her wily prey.

Always I had hoped to see this drama. How did the deep-woods hawks — the bird hawks — take the keen and agile pine squirrel? I have watched the big western redtail swoop at this noisy little cone-cutter — and miss. But that was usually when the great buzzard hawk had caught the spunky tree-climber out at the swaying end of a conifer bough. How could the accipiters regularly take toll of his numbers when the red squirrel kept within evergreen cover?

It is these winged hunters, goshawk, Cooper's and sharp-shin, who keep the chickaree, himself an intermittent predator, within proper bounds. Birds are their usual prey. And, in the way Nature has decreed, they serve the songbirds and other avians by keeping them within the limits of their food supply. Where the wild has not been materially disturbed by man, hunter and hunted are in perfect biotic balance; each, in fact, requires the other. But in the complex interweave of all species within a life community, Nature never sets any group apart. The accipiters also prey upon the elusive pine squirrel; thus directly checking this occasional nest-time enemy of the birds. Now, at last, I was watching how the streamlined blue darters do it.

At each strike of the hawk the squirrel spiraled around the pine, raced upward with surprising speed, or slithered down the scaly bole with the whipping sound of a rip saw as needle-sharp claws tore the bark. Often in wild but skillful escape, he reversed direction and appeared above the hawk as she plunged on downward in baffled pursuit. When she perched he would hunch snugly on a limb-butt next to the tree-trunk, plumed tail arching over his sleek back, promptly to sputter and fairly spit defiance.

Why the attacker, for all her fierce prowess, continued to strike somewhat puzzled me. There seemed slight chance of capturing her intended and indignant victim. The yellow pine at that height was all of two handbreadths in thickness — ample protection for the dodging chickaree — and she was engaging the cleverest acrobat of the tree-trunks. For her there could be



Cooper's hawk nestlings at home. These are youthful but belligerent scions of the true bird hawks.

no opportunity for sustained and exhausting chase such as that by which the pine marten overtakes such nimble prey. Only by lightning pounce in some moment of unwariness or miscalculated flight might she hope to seize her intended victim and be off with him.

But her hot hunting blood was stirred; the Cooper's hawk seemed entirely to forget me. Down she dropped from her high perch in the green-needled crown, plunging swiftly and erratically close on the squirrel's reckless, zig-zag course. Hurtling thirty feet through the spike-like branches, matching every twist and turn, she rocketed after the saucy little daredevil, never more than a swift clutch from the rippling fur of his back. In briefer plunges she had pressed him close. Now she appeared to drive him down through the bare-limbed maze so desperately that he could never turn or climb, but only twist among the dead branch stubs until forced below their doubtful protection. With the binoculars I followed them in the hectic plunge, expecting every second of the rocking, side-slipping dive that the amazing bird hawk would make her kill. Barred pinions flashed and closed, dropped or checked her for an instant, turned or drove her groundward in the plummeting strike. The cut of air through stiff quills, and the occasional wing-tip slashing past a branch, slit the forest stillness like the rip of tightly stretched canvas. I found myself breathless.

Black-capped chickadees came trooping through the sun-splashed undercanopy just beneath the bird hawk's aerie.

Who could ever imagine there was such skill in wings?

Neither the hawk nor I fully knew the squirrel's resources. Down where the trunk was limbless, in a wild flurry of flying bark scales, he suddenly swirled around the trunk and vanished, to appear quickly far up toward the green upper boughs again.

The contest barely slackened. Following such an attempt the powerful raptor would glide on out, then curve sharply back to swoop again upon the chickaree. The undaunted little fellow would instantly shift around the creviced bole, and either drop or climb to stay in the area of bare branch protection.

At times, with the glasses luminously revealing hooked talons clawing past within a feather's breadth of him, I scarcely suppressed shouts of warning and advice: "Take to the tree top!" There the long-needled foliage and heavy, denser boughs seemed to offer safe refuge. But now I had seen enough. The chickaree obviously preferred mid-level branches where the trunk was thicker. And this situation demanded an expert.

Unexpectedly the winged huntress would leap from her perch, rise a limb's length vertically through the branches, and, turning, strike upward relentlessly at her prey. After one such maneuver the bark of the scolding squirrel reached the high fever-pitch of uncontrolled excitement.

Frequently it had seemed he was a

The red-eyed vireo's sweet recitation seemed scarcely disturbed.

bit disdainful of his assailant. Now, constantly chattering, the chickaree daringly descended around the tree-trunk. In short, jerky, provocative jumps he edged recklessly within a long leap of the deceptively indifferent raptor. Like a wing-flash she spun upward, rolled in midair, and struck with deadly upthrust talons. I thought she had him!

In the bright close-up circle of the binoculars, held waveringly by aching arms, I saw her clutching feet strike into the first dust and showering bark of his whirling retreat. Indeed I followed her on out into the clear of the forest mid-story, thinking to see her carrying the kill. But in her wide impressive sweep around the pine she was empty taloned!

Once again, after a fruitless pounce amidst the baffling branches, the attacker glided far out on a wide swing about the pine. The red squirrel, as if he had suddenly acquired caution, seized the opportunity to race to the end of a bough opposite and leap to the heart of a thickly branched, densely needled fir. His adversary soon swung away to the great tamaracks up the hill.

My gaze wandered, but presently it seemed I glimpsed the hawk flying away through the woods. The squirrel knew. He quickly came down trunk into the open, and silently, with long graceful hops across the forest floor, hustled into tangled ground cover.

Then came the clear, swinging notes of a western tanager, and other birds returned to summer song.

Early golden sunlight glinted on needle-plumed pines, next morning, as I strode through russet-columned parks to push on into broadleaf-conifer wood at the foot of the hill. Some things I had seen and reflected upon brought me there. So it was, scarcely beyond her own widest circle of flight up the steep slope from the squirrel tree, I discovered the hawk's nest.

Among the Douglas firs and towering tamaracks on the hillcrest I soon sensed a broad-winged hunter making off distantly through the timber. Barely then, I lowered my eyes, and there it was — the bird hawk's aerie! In an aperture of the leafy under canopy its ragged bulk loomed against the sky. The bent trunk of a many-stemmed, slippery boled water birch lifted it well into the lesser treetops.

No accipitrine defender stood alarmed upon the wide, stick platform. A ruffed grouse drummed just beyond. Perhaps the huntress had not yet taken possession of this old, weathered citadel; but she might return. I stole to the birch clump, frequently sinking into the black ooze of hillside seepages, and sat down beneath the nest amidst lush green of osiers, star Solomon's seal, and golden mimulus. One would not expect the grouse to stay; this was moving in too close. But I would wait for the bird hawk.

Yet in the next half-hour the grouse drummed again, rolling out muffled wing-thunder from heavy under cover just up the hill. Turning slowly, I searched there with the glasses; and when the throbbing wing-beat reverberated, marked him through the lattice maze of the leafy shrub-tangle. In a single shaft of sunlight, against bordering evergreen thicket beyond, he stood for minutes motionless before breaking into his thumping roll. From where I reclined against the leaning nest-tree, his station on the ancient, mossy drum-log was little more than a dozen paces away.

Presently a pine squirrel scampered along a nearer fir log; and within a sheltering, thorny barricade of wild roses, paused to give his quavering "song." It was his frequent haunt, as told by deep litter of fresh cone-cuttings strewn atop the fallen fir.

Mosquitoes sang, too, and needled me persistently in the rising, humid heat. It was time to press on through the tangled underwood. Suddenly turning, I saw the female Cooper's hawk, half-raised, watching over the edge of the platform nest. Plainly, on arrival, I had glimpsed her departing mate. Discovered now, she mounted to a nearby tamarack and called. Then dashed upon me as I returned to linger under the nest-tree, swerving away with a splendid bank of blue-mantled wings. Repeatedly her wild *kuk-kuk-kuk-kuk*

assailed me. Frequently she sallied from the forest in attack that swept close beneath the leaning birch.

To enjoy her courage, her challenging call and flight display, one would endure the mosquitoes longer. Occasionally a tossed cone or a stick brought her back in wild and anxious, but harmless assault; and through the racketing I noted the reactions of her woodland neighbors. Surprisingly the grouse cock remained, silent, unmoved, yet not retreating from his drum-log. This I noted many times. The chickaree near by broke into the hawk's fierce cry, and scolded with confident "profanity."

Finally other birds resumed interrupted song. Olive-back thrushes flooded the woodland with silvery overtones. A redstart's reedy flute pervaded the underwood; and the red-eyed vireo's sweet recitation seemed scarcely disturbed. Midget ruby-crowned kinglets regularly emitted dire warnings, that were relayed throughout the wood; then continued their aphis-hunting overhead in the hawk tree. But a family of chickadees trooping through the sun-splashed undercanopy around the big birch were not at all perturbed. Beneath the nest, a small sapling's length from where the worried raptor still swooped at me, one black-cap was absorbed in subduing an elastic, leaf-green willow borer just hauled manfully from its secret tunnel. A MacGillivray warbler chit-chatted deep within thimble-berry-osiers. Fear was present, but not dominant.

True the bird hawk pair would take their summer toll here. But there was safe cover for the hunted. Usually it would be of the unwary, the injured, the least skillful and the weak. It followed that no avian overpopulation would destroy the food resources of the wood. No crowding would bring epidemic disease. The accipiters were a normal and needed control-factor in the forest. Theirs is a rightful place wherever a bit of wilderness survives.

Here, within a stone's heave of the bird hawk's aerie, was proof enough that Nature takes care of her own. Our superficial moral judgments condemning predators have no place in the proved Plan of Things in the wild.

The pine squirrel's high-pitched *ka-chic-chic-chic* cut sharply across the hawk's stirring cry again.

To the naturalist — to anyone who has deep understanding and love for the wild — his most thrilling and memorable moments likely come when predators cross the trail. There is action when a hunter strikes!

My World Life List of Birds

By STEVEN CAMBRIDGE

MY LIFE list of birds (those I have personally seen) now numbers 23 species. Among them are birds as exotic as Marquis Raggi's bird of paradise. True, the world contains several thousand species, but I only started two months ago. Yesterday, for example, I added a cassowary, the flightless, nearly man-sized bird found in the islands of the Malay Archipelago. Two days before it was an African ostrich, and this morning a ruby-throated humming bird.

No, I am not a world airlines pilot. And I do not mean captive birds in a zoo. I live and work in New York City.

Some time ago, with the approach of winter and a lessened opportunity to go afield birdwatching, I began to fret. I wondered how I could possibly survive until a new spring brought the myriad beauties into the range of my binoculars once more.

The solution came to me as I was idly turning the pages of a national magazine. I saw a full page advertisement in brilliant color. It concerned some mechanical product and pointed up the wisdom of buying it by the picture of an owl. It was a wonderful owl, very clearly and unmistakably in focus. From Peterson's *Field Guide* I decided it was beyond question a barred owl. That was the start of my world life list.

From that moment I began to read magazines with an additional purpose never suspected by their editors. I have gone through a stack of back numbers that lay abandoned in a closet in my apartment. My life list is growing steadily. And as it grows, so increases the complexity and interest of my new venture. I decided to limit myself to magazines and newspapers, to advertising brochures and other ephemera. I was not going to massacre my books, however many wondrous plates of birds they contained. That would be cheating I reasoned — for I might as well buy all the bird books I could lay my hands on and be done with it. No, there must be an element of discovery; of the chase. Each turning of a page must be coupled with a breathless sense of anticipation. And occasionally I hope to stumble on a great richness; an article on birds! — perhaps illustrated in full color. Then will my scissors work busily.

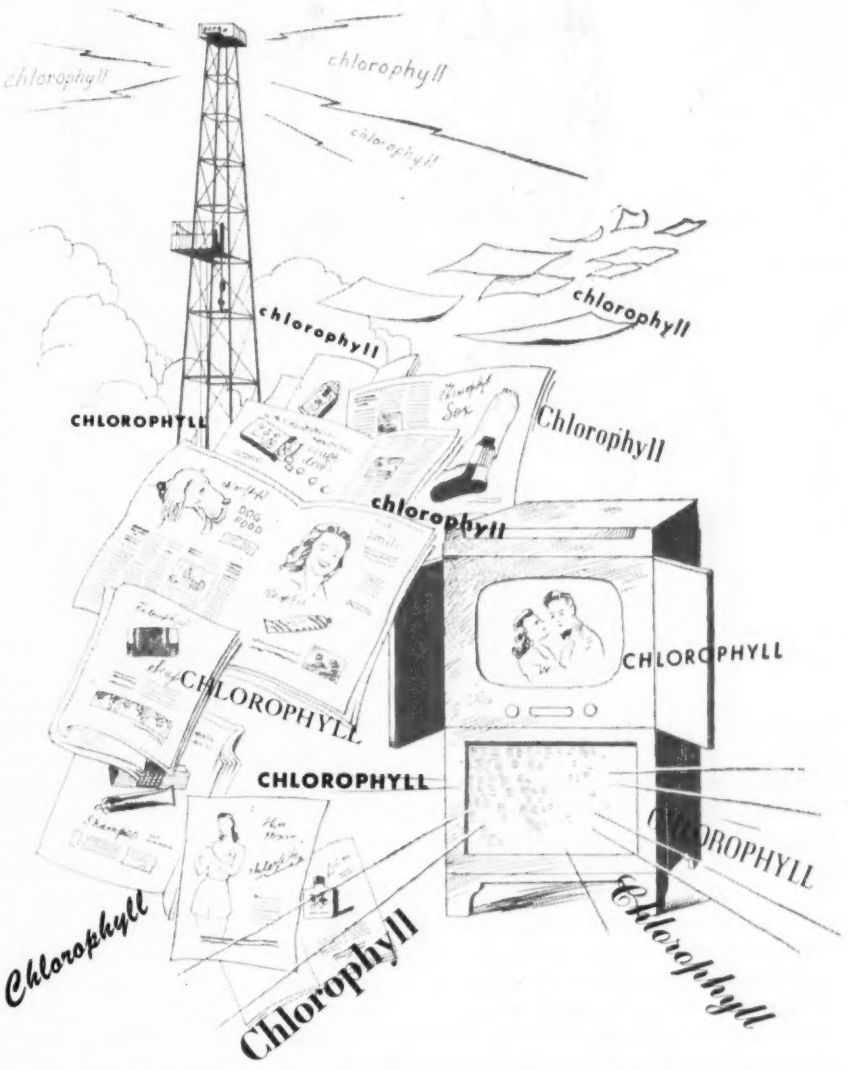
I have purchased a scrapbook, but I have not pasted any of my finds in yet, pending the working out of a satisfactory system of classification.

Problems arise: What is to be done with "birds" — undoubtedly birds — but such as exist only in the artist's imagination? I mean those that wear hats, or smoke cigars, or ride in a car, or look like a cross between a prairie chicken and a penguin. Why, I will cut them out all the same, but I plan to put them in a special appendix of my scrapbook and not in the more serious and scientific body of the work. That, of course, would be the surrealist appendix. Another section will be devoted to extinct or fossil species.

The Chlorophyll Craze

By BRYAN HOUSTON

Illustrated by Garnet Jex

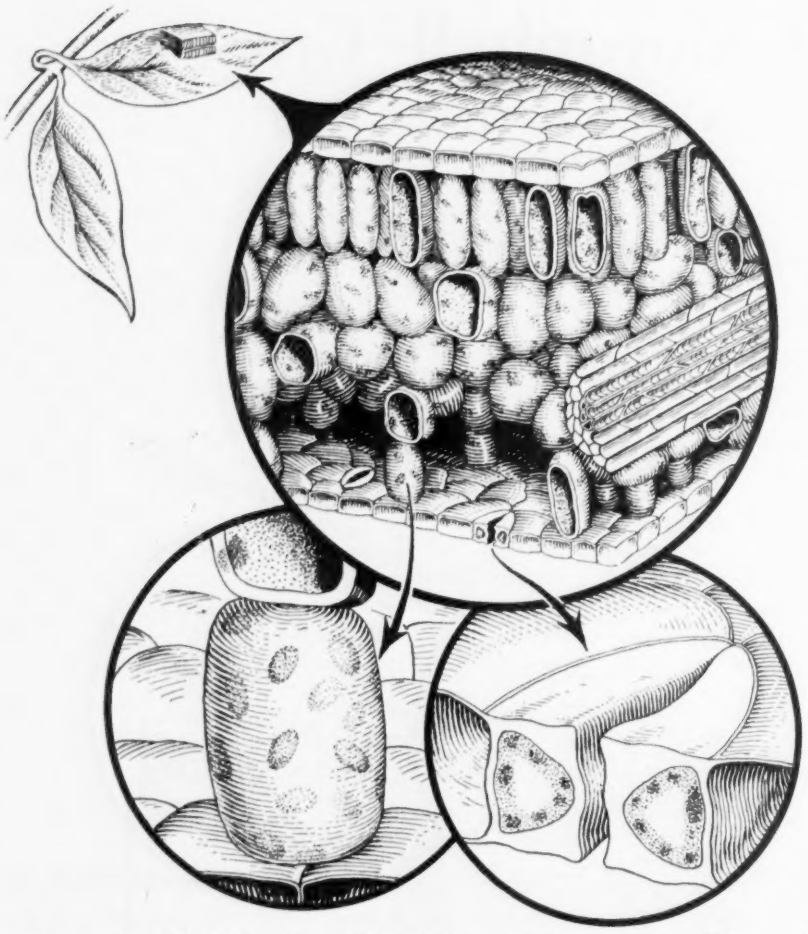


UNTIL just a few years ago chlorophyll was something which interested botanists, chemists, and naturalists. Most people were only vaguely aware of it, if, indeed, they had heard about it at all. Now, the advertising hucksters have gone the limit with the "fear" technique — fear of offensive personal odors. Through every medium they assure us that chlorophyll can free us of both our odors and our fears. Now everyone has heard about chlorophyll. Yet few people really know the actual facts about either its function in plants, or its value as a deodorant.

Within the last three years our purchases of chlorophyll tooth pastes, chewing gum, lozenges, and myriad other products have nourished the chlorophyll industry from an infant into a multi-million-dollar-a-year giant. Although chlorophyll room deodorizers have been on the market for some time, the great chlorophyll boom did not begin until 1950. At first there were only a few "chlorophyll" products, but soon "chlorophyll" appeared in our shampoo, bubble bath, cough drops, mouth washes, colognes, after-shave lotions, foot powders, and even talcum powders. "Chlorophyll" dog food appeared, so that we could also deodorize our dogs. As one manufacturer after another realized that a green bonanza was at hand, and surveyed his products for ones to which he might add chlorophyll, the matter reached the silly stage. "Chlorophyll" began appearing in cigarets, shoe insoles, pajamas, underwear, socks, toilet paper, and even sheets and pillow cases. Where it will end no one knows.

Just what are the facts about "nature's deodorant," as the advertising writers like to call it? Is it really an effective deodorant? Is it an important discovery of modern science? Or is it just another one of those pseudo-scientific fads that the public keeps falling for — a modern version of the old-time medicine man and his rattlesnake oil? Only the most trusting people believe the advertisements give the facts about chlorophyll. And most articles have provided none too reliable information about chlorophyll as a deodorant, and they have usually presented a distorted picture of the role it plays in plants. Some of the consumers' organizations have published reliable reports of preliminary tests of the value of "chlorophyll" products, but these have been available to only a relatively few people.

Chlorophyll plays an important part in the life story of green plants, but its service in plants has absolutely



A look within a leaf, showing the complicated manufacturing plant where chlorophyll is produced. Adapted from Bonner and Galston's *Principles of Plant Physiology*, published by W. H. Freeman and Company.

nothing to do with deodorizing. Chlorophyll makes it possible for green plants to absorb energy from the sunlight, and this trapped energy is then used in making sugar from water and the carbon dioxide gas of the air. This process is called photosynthesis, and was originally discovered by the English scientist Joseph Priestley in 1772. In 1779 Jan Ingen-Housz, a Dutch physician and scientist, discovered that only the green parts of plants could carry on photosynthesis. Although photosynthesis has been studied extensively by botanists and chemists ever since, it is only recently that radioactive carbon dioxide, and other tracers, have made it possible to obtain any sort of detailed information on how this important process goes on in plants. However, the chemical structure of chlorophyll was worked out by the German chemists Richard Willstatter and Hans Fischer, and by the American chemist, James B. Conant, president of Harvard University until his appointment as U.S. High Commissioner in Germany, during the first part of the present century. Scientists were, however, able to extract chlorophyll from plants long before its chemical nature was known.

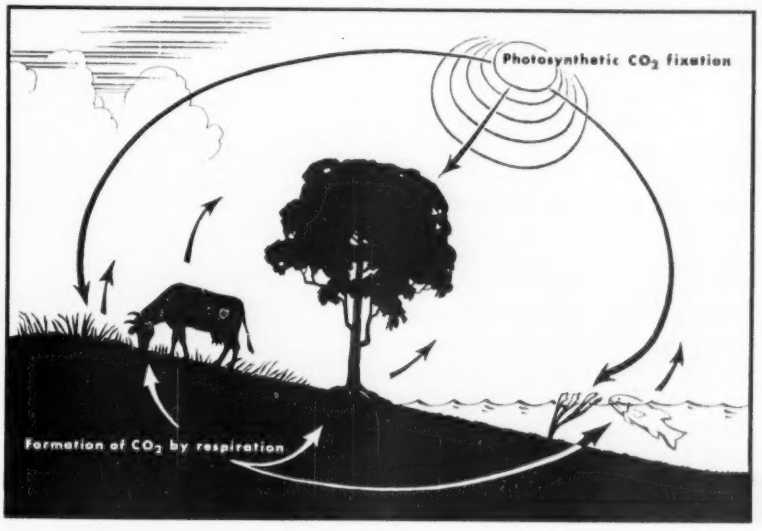
Chlorophyll is undoubtedly one of the most important of substances, since it is essential for photosynthesis, one of the most important of processes. The sugar made by plants in this process is the only really new source of food. All the other foods and substances made by plants are derived, more or less directly, from the sugar made by photosynthesis. Animals must get their food by eating plants, or animals which have, in turn, eaten plants. Since plants, as well as animals, must have food both for building their tissues and as a source of energy for their life processes and activities, life on earth would disappear by world-wide starvation if it were not for photosynthesis. We depend on photosynthesis, not only for our food, but also for the many other items of commerce that we obtain from plants and animals — things such as lumber, paper, rubber, cork, drugs, chemicals, leather, and many others. When we burn fuels we are releasing energy from them for use in our homes, industries and transportation, and this energy in the fuels was originally trapped from the sunlight by some green plant or another while it was carrying on photosynthesis. This is just as true of the fossil fuels such as coal, gas and the petroleum products as it is of wood, since all these fossil fuels are really just the partially decayed bodies of ancient plants and animals.

Photosynthesis is important for still another reason. Oxygen gas, as well as sugar, is one of the products of photosynthesis, and this is the only natural process that adds any appreciable amount of oxygen to the air. Since oxygen is removed from the air by the respiration of both plants and animals, including humans, by combustion, by rusting, and by many other processes, it is clear that without photosynthesis the oxygen of the air would in time all be used up, and almost all living things would suffocate.

The fact that green plants add oxygen to the air, and remove carbon dioxide from it when they are carrying on photosynthesis, has given rise to the common statement that green plants purify the air. In a sense this is true, but it is important to note that plants do not *deodorize* the air, since neither carbon dioxide nor oxygen has an odor. Those who call chlorophyll

"nature's deodorant" are distorting the facts, for in plants chlorophyll does no deodorizing whatsoever. Claims have also been made that chlorophyll products deodorize because the chlorophyll in them produces oxygen, which, in turn, destroys the odors. This sort of explanation is equally impossible, since chlorophyll can carry on photosynthesis and produce oxygen only in the presence of light, and only when it is present in a living plant. Chlorophyll extracts such as those found in the various chlorophyll products are incapable of carrying on any photosynthesis at all. The truth is that nobody really knows how chlorophyll does deodorize, assuming for the moment that it does have deodorizing powers.

Although scientists have studied chlorophyll for many years, the idea that chlorophyll might be a deodorant goes back only to the days of World War II. About 1940 a few doctors began experimenting with chlorophyll extracts and ointments as a possible means of speeding the healing of stubborn, infected wounds. In at least some cases the stuff did seem to be effective, although some later reports indicated that some other substances extracted from the plants along with the chlorophyll might have been responsible for the healing effects. When Dr. Warner Bowers tried chlorophyll ointments and extracts on wounded soldiers in an Army hospital he noticed that the infected wounds treated with chlorophyll lost their foul odor. About the same time two New York physicians, Dr. F. Howard Westcott and Dr. J. A. Killian, were experimenting with chlorophyll extracts in the hope that they might help cure certain types of anemia, since the substance has a chemical structure similar to that of heme, the pigment part of hemoglobin, which makes blood red. They accidentally noted that, after large amounts of chlorophyll, were taken internally certain body odors disappeared. They and others then began experimenting with it as a possible deodorant. From 1943 to 1950 the possible deodorizing properties were just a subject for laboratory experimentation, except for the room deodorizers that appeared on the market. Then O'Neill Ryan, Jr., an advertising man, became interested in the experiments with chlorophyll being conducted by Benjamin Guskin. Ryan financed his work and established the small Rystan Company for extracting and marketing chlorophyll. In August, 1950, Paul DeKruif published an article in *Readers Digest*. He praised the deodorizing properties of chlorophyll in glowing and unrestrained terms. Soon one manufacturer after another began adding it to his products, the advertising agencies went into high gear, and the great green bandwagon was rolling along attracting a strange following as it progressed.



The cycle of photosynthesis in which carbon dioxide transformed by this process in green plants goes back into the atmosphere when plants and animals respire.

Most people seemed to take the advertising claims at their face value, but a few skeptics were asking why the chlorophyll in spinach and other vegetables would not deodorize people who ate them. One columnist put such a question into verse:

Why reeks the goat on yonder hill,
Who seems to dote on chlorophyll?

There is an answer to such questions. Chlorophyll products do not contain the substance itself, but things such as chlorophyllins, which are formed from the chlorophyll during the extraction process. Chlorophyll does not dissolve in water as the chlorophyllin does, and can not be absorbed into the blood stream as the chlorophyllins can. This could explain a difference in the action of the extracts and the chlorophyll in the plants we eat, but it also brings up a question that has never been fully answered — Is it harmful to take large amounts of chlorophyllins into the body over long periods of time? The chances are that it is not, but no one really knows for sure.

If the chlorophyllin is a copper-chlorophyllin, as most of the commercial preparations are, there *is* a danger of poisoning from continued use of chlorophyll preparations taken internally, especially a danger of damage to the liver. Before the Pure Food and Drug Act was passed some packers added copper sulphate to canned vegetables, since the copper-chlorophyll compounds thus formed did not lose their bright green color during cooking like the regular chlorophyll does. However, since the copper-chlorophyll is poisonous, this practice was soon prohibited by the Pure Food and Drug Administration. The copper chlorophyllins now used are probably equally toxic, although they would be consumed in much smaller amounts than the copper-treated vegetables. In an address in which he pointed out that chlorophyll is not effective as a deodorant, Dr. A. H. Corwin, head of the Chemistry Department

at Johns Hopkins University, recently emphasized also the possible dangers of the copper-chlorophyllins. He also stated that chlorophyll derivatives injected into mice so sensitized them to light that they could be killed by the flash of bright light from a photographers flash bulb. Whether or not a similar light sensitization may eventually occur in mankind who absorb large amounts of chlorophyllins into their blood streams remains to be seen. Dr. Corwin also stated that there was no evidence that chlorophyll, at sixty dollars a pound, was any better in promoting healing or deodorizing of wounds than a solution of ordinary salt costing only a few cents.

Just how effective are these chlorophyllins as deodorants? There seems to be pretty good evidence that there is something in the chlorophyll extracts from plants, although it may be something other than the chlorophyllins, that does promote the healing of festering wounds and deodorizes them. *Large amounts* of chlorophyll extracts taken internally do appear to counteract certain types of odors from the body. Some reports also indicate that in dog food it may eradicate certain dog odors. However, this is just about as far as any sort of scientific evidence for the deodorizing properties goes. Even if chlorophyll does have certain deodorizing powers, when used medically in large quantities, this does not necessarily mean that every product containing a little of the stuff is an effective deodorant. Besides the basic and still unsettled question as to just how effective, as deodorants, the chlorophyll derivatives are as contrasted with the chlorophyll extracts that may also contain other things from the plants, there are other queries that must be answered for each product. Is there enough chlorophyll present to be beneficial, even if it can deodorize? Does the product reach the source of the odor? Is it in contact with the body long enough to be effective? Are there other qualities in the product that really do the deodorizing for which chlorophyll is given credit? Despite the claims of the advertisements, unbiased scientific research planned to answer such questions has been done on only a rather small scale, so far, mostly by the consumers' organizations.

None of these tests has revealed a clear-cut case of deodorizing powers of any of the "chlorophyll" products tested. Pretty green tooth pastes have proved to be no better as deodorants, or in preventing tooth decay or gum infections, than comparable white tooth pastes. Such deodorizing properties as the chlorophyll room deodorizers may have had been shown to be due to the formaldehyde in them, and the Federal Trade Commission has issued an order that advertising claims for these products be revised better to fit the facts. The order forbids continued use of the claim that chlorophyll acts as it does in Nature, which we have seen to be false. In one test on fifty women, who took chlorophyll pills daily for a week, the pills did not prevent underarm odors in any of them. Chlorophyll mouth washes, lozenges and chewing gum have not been shown to be any more effective in controlling either halitosis, or onion and tobacco odors than similar non-chlorophyll products. The same can be said for soaps, shampoos, bubble baths, toilet water, cologne, and talcum powder. Claims that a carriage-trade cologne containing chlorophyll "Restores nature's skin freshness with nature's chlorophyll. . . .The chlorophyll ingredient gently stimulates the skin, actually purifies each skin cell," may sound scientific and convincing to the ladies for whom the advertisement was written, but are recognized by scientists as being pure bunk. A well-known green soap now claims that it has contained chlorophyll for years, but refrains from making any claims for deodorizing properties of this substance.

While claims for such chlorophyll toilet articles approach the silly stage, the heighth of absurdity is really reached with chlorophyll cigarets, pajamas, sheets, pillow cases, socks and toilet paper. Such things are hardly worth testing. That the manufacturers of such products are merely trying to cash in on the chlorophyll craze is indicated by the following quotation from an Associated Press dispatch in regard to chlorophyll sheets: "Trade sources said, however, that the chlorophyll would have some deodorizing effect. They added, too, that textile products so treated would be able to reap benefit from the tremendous promotional advertising campaigns that toilet article manufacturers have conducted for chlorophyll." It is quite likely that the manufacturers of such chlorophyll products are having a good laugh at the customers who flock to buy them.

It would be interesting to know how the manufacturers of textiles impregnated with chlorophyll intend to make a product which will retain any of the stuff beyond the first washing or so. (Continued on page 220)

Cycle

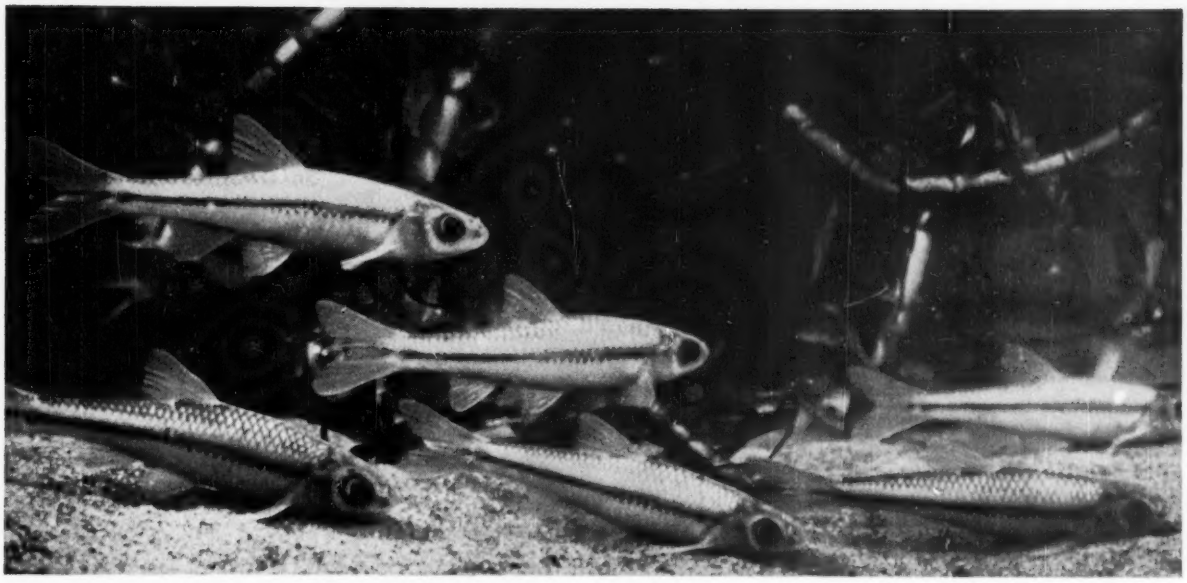
By MARGARET NORRIS

Bright sun
On yellow corn,
Brown tepees row on row
In stubbled field — Spring promise is
Fullfilled.

Dead leaves,
Your work is done.
Earth opens wide her arms.
Sink deep into oblivion,
Dull brown.

White flakes
So softly fall
To blanket ravaged earth
And warm the seeds of life that lie
Asleep.

Green leaves,
Fling up your arms
To touch the rain and sun.
You hold the key of things to come,
Green hope.



The northern swallowtail shiner is a denizen of the small, clear, swift-flowing brooks. It is a delicate, small species that abounds in schools wherever it is found.

Consider the Minnow

By ROMEO MANSUETI

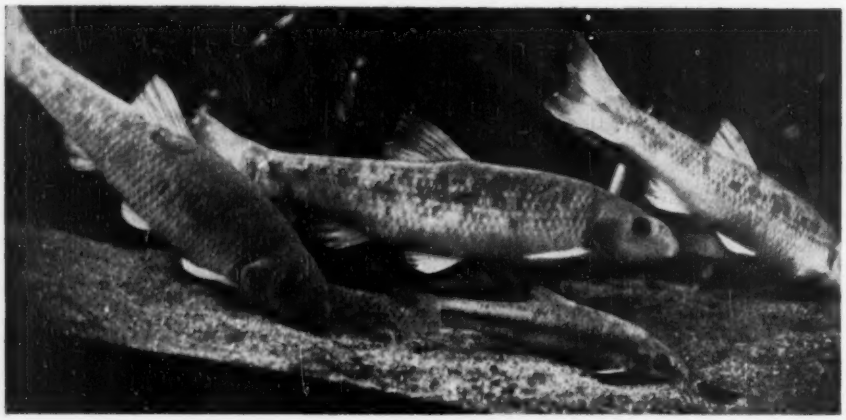
Photographs by the Author

IN THE spring, when young men's fancies turn lightly to — well, among other things, to angling, few Nimrods spare more than a glance at the elaborate display of finger-sized fishes that teem in fresh-water streams of the United States. If the water's surface were a mirror of the silvery spurts of live darts beneath, all the water-world would be a stage of multi-colored minnows. Few of the finny folk can even approach the bright costumes of the minnow tribe. Furthermore, minnows are both abundant and fascinating, and anyone who has spent his childhood in the country may recall how he ornamenfed his string of fishes with "minnies."

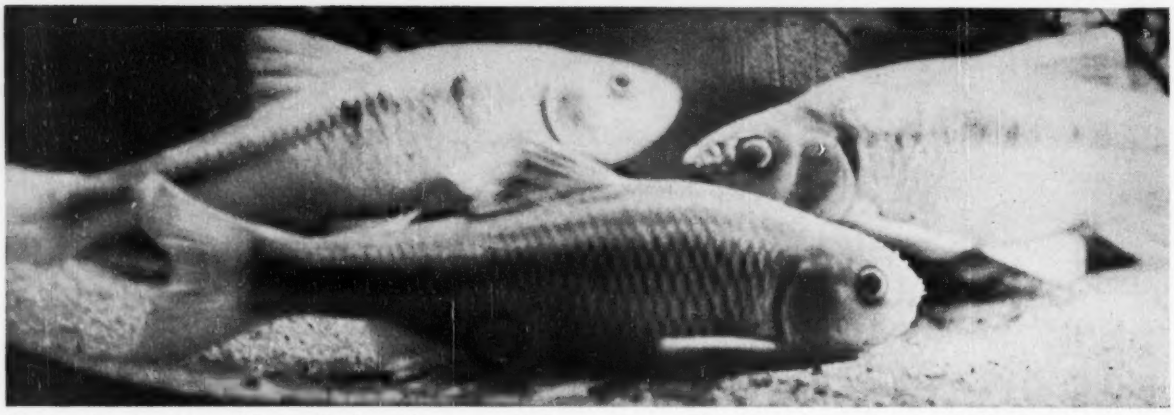
Many people think of minnows as nondescript fishes that just happen to live in the same stream with such glamour species as trout and bass. Were they to delve into the life story of even the plainest species, they would be astonished at the complex behavior patterns and the gaudy colors that accompany courtship proceedings. The breeding dress of male minnows strikes one as being out of step with dull muddy bottoms that are minnow havens. Nevertheless, a minnow Mardi Gras cannot fail to please even the most indifferent person. Even hardboiled ichthyologists have exulted over the rainbow hues and courtship antics of minnows. Professor Edward D. Cope, the exacting and astute pioneer zoologist of the late 19th century, stated that the blacknose, redbelly, and redside daces ". . . are in no wise inferior to the tints of the boasted trout in his brightest array and the admired gold-fish does not gain by comparison."

Minnows are throat-chewers, that is, they possess elaborate elongate teeth in the region of the pharynx. They have no other teeth around their lips, and for this reason, among others, the giant carp is a minnow, or, if you like, all minnows are carps. Dr. John T. Nichols, the venerable ichthyologist of the American Museum of Natural History, speaks of the "carp" family rather than the "minnow" clan. In scientific parlance, the family *Cyprinidae*, contains such a galaxy of minnows — or carps — as: roaches, shiners, chubs, dace, goldfishes, ides, tenches, and other individualistic appelations. Unfortunately, "minnow" has been loosely applied to the young of various other fishes of different family ties. The adults of certain other American fish families that resemble cyprinids superficially are also called "minnows."

A minnow is as well-known as apple pie, yet to describe one to a small boy is a chore. The safest way is to wait until you use one for bait. Look at it closely before you slip it on the hook. It might look like a penknife blade with a single fin mounted like a sail, with a single spine, and about nine rays. If you were to peer into its little mouth, no teeth would be visible. In order to find the pharyngeal teeth, which when magnified, look like crooked elephant tusks mounted



The stoneroller minnow, left, is unique because its long intestine is always wound spirally around the swim bladder. This feature cannot be detected externally, but the species can be identified by the fact that it looks superficially like a juvenile sucker. During the breeding season the head of the male, and the entire top of the back is covered with sharp, needle-like, breeding tubercles. These are used as defense and to nudge nesting females.



The male common shiner displays horny protuberances on the head in spring, and during this time they are very colorful. They reach a size of about ten inches and are often caught on hook and line by children.

in a bone, one must probe carefully through the gill openings to extract them. This is a tedious and unpleasant task even to the fish classifier. When I dared a dentist friend to use finesse and care in extracting teeth from a minnow, without injuring the jaws, he gave up in despair after a few minutes.

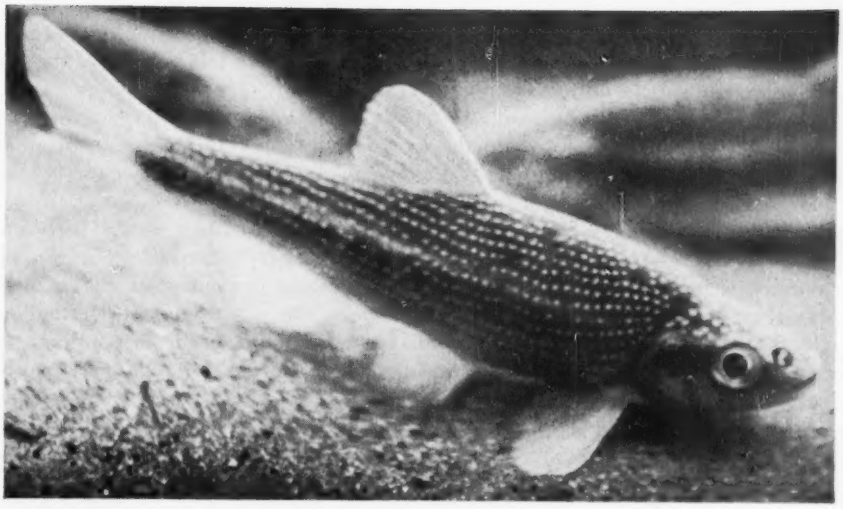
When in nuptial dress the brilliancy of the coloring of American minnows attracts the most indifferent person. Many are caught to be admired in aquaria, but they fade in only a short time after removal from their native haunts. A parade of every species of minnow in North America — and there are more than 300 — would amount to a rainbow in all its miniature glory. One species is particularly well-known and widespread. Unpretentious in name, the common shiner more than compensates for this oversight with its color and unusual appearance in the springtime. Bright rosy bellies and lower fins, and a delicate pink overall color greets the eye, but, after this initial Technicolor surprise, the grotesque spiny growths scattered over the fish's head next halt one momentarily. The male common shiner uses this seasonal makeup to appeal to females, perhaps in the act of spawning, and to fight off competitive males. The entire spawning act is accomplished in a fraction of a second. The male corrals the female in the middle of the nest and then throws his body into a curve about the upright body of the female; this is followed immediately by egg-laying.

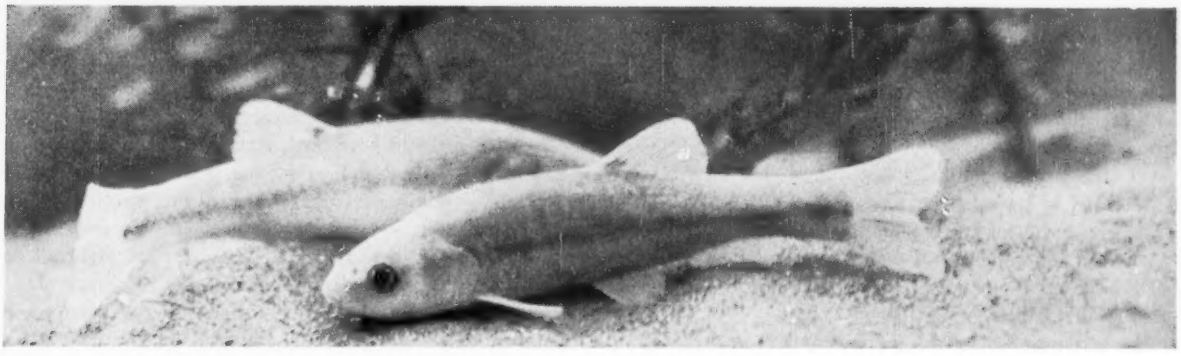
Among our native species that could easily masquerade as an exotic aquarium fish, the redside dace would easily take first prize. Spring males are bright crimson on the front part of the body, with a broad, black lateral band. The first seine haul that I made for these fishes was half full with colorful males that appeared as if they had broken out in whitish goose pimples. Actually these seasonal excrescences, controlled by the male sex hormones, are used in the courtship proceedings. By midsummer they have all but disappeared. Such tubercles, as well as other facial ornaments of minnows, are harmless to humans; they are ineffectual in even tickling a human hand. So far as is known, there are no known dangerous minnows, although the carp possesses a heavy, serrated spine in the top fin and in the anal fin, which can inflict an ugly wound in one's hand if the fish struggles too violently when grasped.

The redbelly dace is considered by most fish fanciers to be the most handsome minnow in our Hemisphere. It is a small brownish species with black spots on the back, two blackish stripes along the sides, and bright red bellies in the spring males. During the spawning

The eastern redside dace, right, is one of the most colorful minnows of the eastern United States. In spring the males display the nuptial tubercles that cover most of the body.

The northern creek chub, below, is an abundant species that reaches a size of about ten inches. It is easily recognized by the dark spot located near the front base of the top fin. It is a nest-builder, the male preparing the nest and guarding the eggs until incubation is complete.





period in spring, a single drab-looking female may be attended by several painted males. Dr. G. B. Cooper, fishery biologist at the Michigan Institute for Fisheries Research, observed that when more than one male pursued a female, the first male to be attracted to the female took up a position a few inches behind and just below the female; other males joining in the pursuit took up positions behind and more or less in line with the female. After being pursued for several feet the female darted headlong into a mass of algae where the struggle resulted in spawning. The pearl dace is also a bright-colored species in spring, but during late summer and winter, its colorful hues fade away. In spring the rosyface shiner lives up to its name so well that it is frequently believed to have injured its head, which appears to be bleeding, when the fish is caught in seines or minnow traps.

It would be difficult to look into the mouth of the cutlip minnow because its lower lips appear to be suffering with mumps. This sluggish-moving species, unlike its neighbors of slow-moving creeks, carries on rather strange nesting habits. The male in late spring constructs a nest near or partly under rocks by collecting pebbles, one by one. The male selects each stone with care and transports them to a chosen site, moving as many as six stones per minute. Miss E. M. Van Duzer, a student of fish life histories, observed a male to steal stones in considerable numbers from nearby nests in absence of the owner, who some time before had vigorously guarded the mound-like nest. The male circles its nest in anticipation of the arrival of a female. When they meet the female thrusts her head under the body of the male near the vent, slides her head along the side of the body. The bodies are curved in a curious embrace, after which the eggs are passed out and fertilized.

An underwater Hercules Club is difficult to imagine, yet the male bluntnose minnow easily gives the illusion. It is one of the most familiar species among bait-fishermen. The males possess three very pronounced rows of large spinous protuberances. According to Messrs. Samuel Eddy and Thaddeus Surber, two well-known zoologists of Minnesota, the male fans out a cavity under a stone or board with its tail. The female deposits the eggs in the cavity, and the male guards them. This species is a prolific breeder. Young individuals, normally difficult to identify among other minnows, are really very easy to recognize.

Bluntnose minnows may aid in public health programs if their services are required. Doctors A. D. Hasler and W. J. Wisby, zoologists of the University of Wisconsin, actually trained these minnows for the olfactory assay of pollutants in water. They trained these fishes to detect the presence of phenols below the

threshhold for man. Phenol, a common pollutant in municipal water supplies, cannot be readily detected in low concentrations until it has reacted with chlorine, forming odorous chlorophenols. Minnows of two aquaria were trained to associate the odor of phenol with food; and the odor of a p-chlorophenol with punishment. The minnows of two other aquaria were trained to the same two odors, but with reverse meanings. Upon completion of the training period, the minnows were discriminating successfully between these two substances at concentrations very much below the threshhold value for man. As yet, minnows are not being used for these purposes in actual public health practices.

The stoneroller minnow, a pale-brown species with thick and fleshy lips, is really one of the most remarkable fishes from an anatomical standpoint. The intestine is wrapped many times around the swim bladder, a situation that is not encountered in any of the other minnows. It is almost sucker-like in its appearance, and resembles it very much in habits, feeding largely on the bottom upon vegetable matter. Dr. Edward C. Raney, the well-known ichthyologist from Cornell University, discovered a hybrid between the stoneroller and the Carolina chub, which has a shorter intestine the loops of which lie entirely below the air bladder. The hybrid possessed an intestine that was intermediate in length, but it was not coiled about the air bladder, although the loops were observed far up on either side of the air bladder.

Even minnows seem acutely aware of a housing shortage if their efforts to achieve territoriality in nature are considered. Dr. Raney discovered that the Carolina chub, a common minnow of the Piedmont streams of Virginia and North Carolina, builds a circular nest of pebbles in late June. He also found that these nests were used as breeding sites by many other common minnows in this area. Among them were the mountain redbelly dace, the eastern rosefin shiner, and the Roanoke common shiner, all of which were holding breeding territories over one nest. On one occasion he observed about ten male eastern rosefin shiners jockeying for positions about four or five inches over stones of the nest. The largest males held the upstream positions while the smaller ones were forced to the apparently less desirable spots on the downstream part of the nest. There was intense and constant competition for the entire nest area. Any aggressive move was immediately met by a short, savage rush by an adjacent male.

One of the most interesting series of observations were made over 40 years ago by Dr. J. Reighard, one of the early fishery biologists of the middle-West. He described a peculiar ceremonial behavior as a "deferred combat" between two male creek chubs that were fighting for possession of a nest. He observed that, in starting a nest, the male picks up pebbles from one area and carries them short distances against the current before depositing them, finally forming a mound of washed stones with a cavity downstream. The laborious building of the nest and the careful guarding of the eggs are the exclusive tasks of the male. The odd behavior occurs when a strange male approaches the side of the nest where he is joined by a guarding male, whereupon the two fish as a pair swim upstream with great deliberation for a distance of 15 to 20 feet. In their course they move slowly and swing their tails from side to side in unison, as though keeping step with one another. Dr. Reighard writes, "At the end of their course they settle down to the bottom and bring their heads together and finally separate, the owner to return to his nest, his companion to some nearby shelter." This curious behavior has also been observed in other minnows.

A European scientist demonstrated about ten years ago that a certain species of minnow required light for the completion of sexual maturity; presumably, the absence of light for long periods during the breeding season would inhibit reproduction. Dr. Robert W. Harrington, of the biology department at Trinity College, found in a series of experiments that the bridled shiner, native in the Atlantic coast watershed rivers, spawned in mid-February, at least three months in advance of its normal spawning period. This premature spawning occurred after subjecting the fish to 17 hours of light per day, the experiment commencing a little over six weeks before. Other shiners, maintained at virtually the same temperatures and to normal daylight throughout the same periods as the premature spawners, failed to develop the secondary sexual characters peculiar to the breeding season. These showed no evidence of breeding behavior and failed to spawn. Such experiments demonstrate that minnows are far from simple organisms and that their physiology is closely coordinated by internal secretions that may be as complex as those of higher vertebrates.

In some States, particularly in the mid-West, minnows are big business. Many anglers fish with live or prepared bait, and in recent years it has become necessary to supply the demand for minnows for this purpose. Commercial bait dealers construct special ponds, propagate bait minnows, which are a conglomerate of several species. The dealers may harvest as much as 300 pounds per surface acre of water if good management techniques are employed. Bait minnows may be classed in two general types on the basis of size — large individuals four to eight inches long, used mostly for trolling, or as decoys for spearing large game fishes; small minnows two to three inches long used in line fishing for smaller game fishes. The larger bait minnows include creek chub, common shiner, river chub, golden shiner, and stoneroller; the small bait minnows include the young of the above and bluntnose minnow, emerald shiner, sand shiner, spottail shiner, and even goldfish.

Minnows are of only indirect economic value. Big fish eat little fishes, the "little fishes" are usually the minnows. They are competitive with larger fishes in that they occupy the same (Continued on page 220)

The prairie dog has many enemies, the greatest of which is man, whose interests are seriously affected by the animals' appetite for forage.

It's A Little Dog's Life

By ARTHUR H. CARHART

Illustrated by Robert G. Henneberger

THE CHUNKY, buff-gray burrowing squirrels of western prairies that sat erect beside their tunneled homes, barked excitedly at the early explorers. Because they barked, someone called them prairie dogs.

Lewis and Clark gave them a truer name when they encountered them, in 1805, in western South Dakota. They called them the "barking squirrel." But even before this expedition's official report was made, the dog-name apparently was in common use.

In a footnote to his *Journal*, October 24, 1806, Zebulon Pike, then pushing westward in Kansas, wrote: "The wish-ton-wish of the Indians, the prairie dogs of some travelers, or squirrels, as I should be inclined to denominate them, reside on the prairies of Louisiana in towns or villages, having an evident police established in their communities."

The Indians' "wish-ton-wish" is no more related to the canine family than to zebras or polar bears, but he still remains the prairie dog by popular name.

By any name, sitting upright, flipping his stubby tail as he barks danger warnings, he has been a symbol to travelers that they have reached the place where the West begins. As recently as five years ago, tourists could see "dog towns" beside main highways. Today one must search wide acres to locate one of these communities.

What is happening to wish-ton-wish should not happen to any kind of dog.

Irrigation that turned semi-arid lands into cultivated fields blotted out many dog towns. Federal agencies in organized campaigns have poisoned multiple millions. Vernon Bailey, a wildlife authority, has reported that forage consumption of 256 prairie dogs equals that of one cow. Stockmen begrudge the little animals the range food that otherwise might be eaten by domestic stock, and literally millions of acres of dog towns have been cleared of the last inhabitant by systematic poisoning.

Added to all attacks by man, epidemic disease has swept into many prairie dog areas. Within one season thriving towns have been eliminated entirely as the plague struck.

This lively, interesting little native is a highly social but rugged individualist whose activities and antics always have lent character to the prairie landscape. Man's demands may blot him out, but cannot dim his interesting personality.

The prairie dog family is divided into two groups. The white-tailed species are mountain dwellers, sometimes establishing small colonies as high as 10,000 feet above sea level. Because they do not gather together in so densely populated communities, they have a better chance of survival than the other division of the family.

The town-dwelling, black-tail types live on the plains. They are so socially minded, and so bent on maintaining community life, that when part of a town's resi-

For a time the prairie dog enjoyed some popularity as food until it was called a "dog," which it is not, and enthusiasm for its flesh vanished.

dents is wiped out, survivors draw together and reorganize their settlement. Thus bunched, they are vulnerable to recurrent attacks until all residents are gone.

The family and community life of the prairie dog is well organized. Family units live in their own home, and it is their castle. When danger threatens, a dog from another burrow may dive into a neighbor's tunnel and be tolerated. But let him intrude under other conditions and he is an interloper. Even if he be larger, the householder will oust him, and drive him away in a furious, chattering attack.

The dog home is a tunnel that descends directly to a point six to ten feet underground. From here the tunnel slants upward at an angle to the nest room, which may be only a foot or two beneath the ground surface. This construction makes it difficult to flood out a burrow. Pike states he had one hundred forty kettles of water poured into a dog hole with no results.

Burrows of the plains towns usually are built on flats where cloudburst storms occur. To fortify their homes against flooding, the prairie dog family builds a circular earth wall around the entrance, sometimes as much as eighteen inches above ground level. Each armful of moist earth added to this fortification is firmed by the prairie dog, using his blunt snout as a battering-ram, with all the force of his bent body back of each thrust.

The building of the "chimney" around a burrow is prompted by instinct. A prairie dog pet, reared without contact with others of his kind, was taken to Maine, and allowed the run of the home grounds. Just as if he were in a western dog town, he built the earthen dike around his hole, using his head to tamp it into a solid wall.

The earth mounds serve as lookout points. Prairie dogs are credited with cutting down tall weeds near mounds, so the view may be unobstructed in all directions.

During the two active periods of the day, between sunrise and mid-morning, and from four to sundown, a fat sentinel always is sitting up on a mound. When he barks an alarm, the others gallop clumsily to a burrow mound, sit up, and join the chatter. If danger comes too near, they dive into their burrows and for from thirty to sixty minutes none are in sight. Then one reconnoiters, sees the cause for alarm is past, gives the all-clear signal. In a few minutes the whole town is alive again, gathering food, digging burrows, building mounds, or playing like kittens. Even during the midday siesta, a dog or two will be on watch to warn others of approaching enemies.

Another type of defense against invasion is loose earth in the tunnels. When he is driven into the farther corridors of his home, the head of the family makes certain all the family is in quarters, then he plugs the hole with an earth barrier.

Each inhabited burrow has a "dodge tunnel," built to one side of the main one, about a foot beneath the entrance. Here the boss of the family hides until he appraises the threat that sent him into his burrow. The dodge tunnel serves as an outer guard room for the tunnels and rooms beyond.

Each family usually maintains three burrows, although they live in only one. The others are used for refuge and other emergencies. Field men working on rodent control projects have filled all holes in a town at nightfall. At daybreak the next morning, one in three of the plugged holes are dug out. By evening the other two have been put in order. This has been

a means of estimating the number of families in each town and the total population, based on the average family of a half-dozen residents in each home burrow.

The young, usually four or five in number, are about one-third grown when their parents bring them to the surface in late May. For several days the youngsters are not allowed to stray far from the burrow's entrance. When the alarm signal is given, they are herded toward their doorway by the parents, and sit there, like stubby little pegs, with mamma and papa beside them.

"I don't know what the old lady says to the kids," remarks Donald Spencer, of the Fish and Wildlife Service. "But when she gives the word, they streak into the entrance like mad."

When caught while very young, prairie dogs make fascinating pets. The Spencers reared one, and he was given quarters in their basement. When he sought company, the little dog would come thumping up the stairs, run into the room, squeak and wait for attention. If he did not get it, he would rush to the portiers between living and dining rooms, give them a jerk, swing on them, drop to his haunches and sit up, watching Don Spencer. If this did not succeed, he would rush at Spencer, grab the cuff of his trousers, and tug.

"I always played with him when he wanted to play," Spencer says. "He was just as determined not to play if he didn't choose to. If he didn't want to frolic, — well, I didn't want to tangle with those teeth of his."

While the prairie dog does not face complete extinction, since it is given haven in national parks, it has been wiped out over wide areas of its native plains country.

In their northern range, in Montana and the Dakotas, prairie dogs hibernate. In New Mexico and Arizona, they come out of their burrows on sunny winter days to frisk and feed. They do not store winter food, and where they do sleep through cold days, the fat they store in their small bodies as fall approaches, carries them through to spring greening of the prairies.

Several myths about prairie dogs persist. Old plainsmen often saw snakes and burrowing owls enter holes in dog towns, and spun the yarn that the three species made up a strange family. Owls do use abandoned burrows, and when a rattlesnake slides into a dog hole, he either is running from danger, or on his way to feast on a young member of the family.

Another myth, that prairie dogs always dig to water, is equally untrue. In areas where the first ground water is several hundred feet below the surface, and no water above ground, moisture required is secured from the plants they eat. In emergencies, they have been observed chewing holes in desert cactus in search of moisture. That is an old explorer's trick and the dogs may have shown it to desert travelers.

Because he is actually a squirrel, a clean animal, the prairie dog is good eating. If anyone talks of prairie dogs, you generally hear the old story of how they were shipped East in early days as prairie squirrels and, for a little while, were on menus as a delicacy.

Two homesteaders had gone broke in western Kansas. They had turned to eating prairie dogs in last resort, and found them excellent. They began shipping them as a unique type of wild game meat and their business was flourishing until a disgruntled railway employee exploded their venture.

"Squirrels!" he said. "They're prairie dogs!"

The dog-name did it; the meat markets would peddle no dogs.

When stationed in Lubbock, Texas, a few years ago, the Don Spencers staged a dinner that had the potential of not making friends but definitely influencing people. They had often eaten young prairie squirrels, and wanted to prove how palatable these might be.

The dinner was dressed up with candlelight and all the other trimmings. The meat dish was served a-la-king. Guests had repeated helpings of the delicious food. Then Spencer brought in a whole roasted prairie dog, and disclosed what they had been eating.

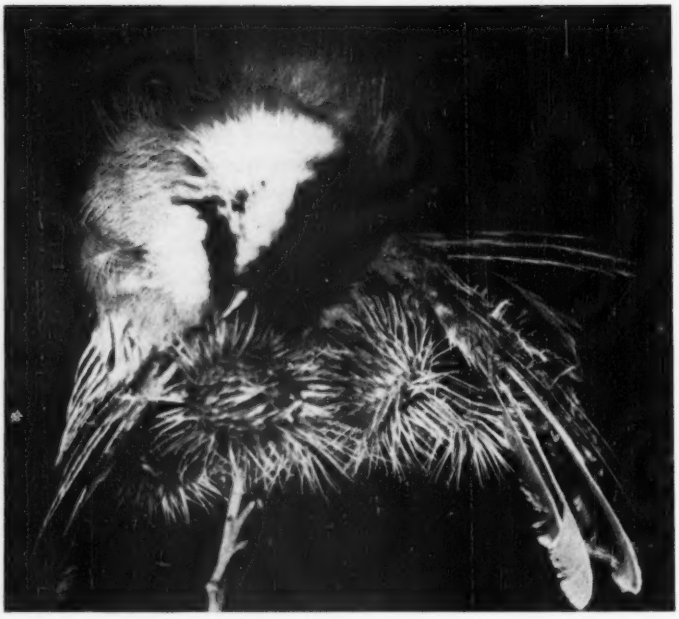
"It didn't set well with some guests," he admits.

During the drought the Navaho Indians faced a decision about their prairie dogs. The flocks of sheep had eaten the grass down to the roots. The prairie dogs were eating the roots. To protect their flocks, the dogs had to be eradicated. But at that moment the prairie dog was a main source of good food for the tribe. It was a difficult choice to make. The need for protecting the flocks tipped the balance against the dogs, and poisoning campaigns began.

Western range and ranch men consider the prairie dog an enemy. When towns and their populations become so numerous they are almost continuous over large areas, the loss in forage can become serious. While each dog may eat only 1/256th of what a cow requires, a few hundred thousand on the range can consume tons of forage. (Continued on page 220)

Burdock and Bird

By LEROY C. STEGEMAN

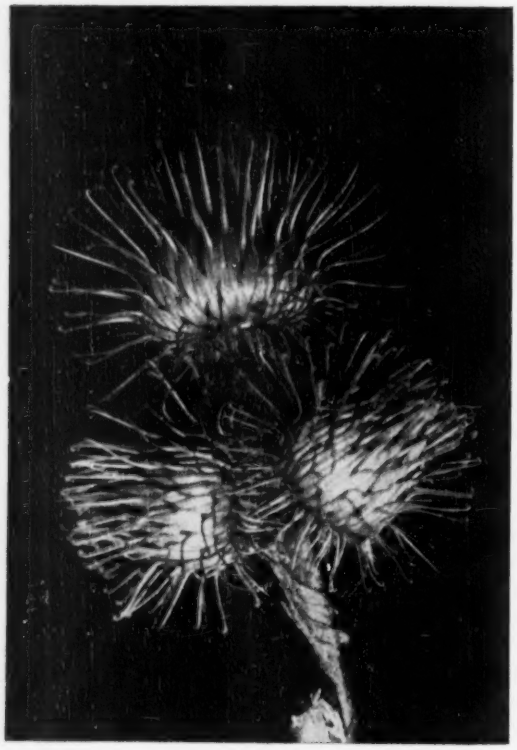


HERE we see evidence of two unusual bird tragedies that took place on the Syracuse University campus.

The first photograph shows how a black-capped chickadee was trapped when it landed upon a cluster of burs of the common burdock. As the bird's wings came into contact with the clump they were held fast by the strong, sharply curved hooks at the tips of the spines. Further struggles served only to fasten the chickadee more securely to the mass.

When the chickadee was discovered by Richard Tuft, one of the university students, it was dead in the position shown. Both wings were held firmly by many barbs, which can be seen penetrating the plumage. Even the tail was held tightly where the bird had evidently pressed it during its struggle to free itself. The feet were free from the mass, and the body lay with the breast held tightly against the burs.

The second photograph shows a warbler held securely by the legs and feet. It also had landed on a clump of burs only to be held securely. It was found dead in the position shown in the photograph at lower, right.



The third photograph shows the formidable structure of a burdock bur. The many sharp hooks serve primarily to distribute the seed of the plant. The hooks attach the bur to passing objects which frequently carry them great distances.

Each bur contains many seeds closely crowded together. These are scattered by the weather or distributed by temporary hosts. The wide distribution of the burdock is ample proof of the success of this method of seed distribution.

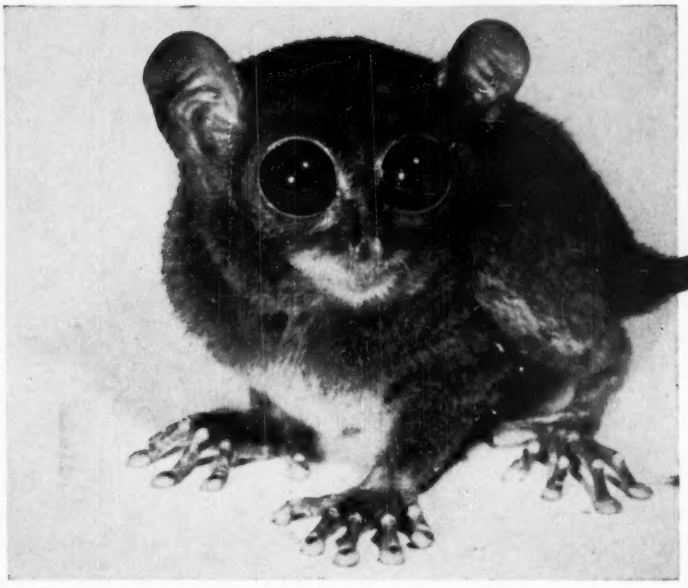
The author would be interested to hear of other similar incidents. Write him at State University of New York, College of Forestry, Syracuse, N. Y.

Tarsiers — Night Prowlers of Asian Islands

By ERNEST P. WALKER,

Assistant Director, National Zoological Park, Smithsonian Institution

Photographs by the Author



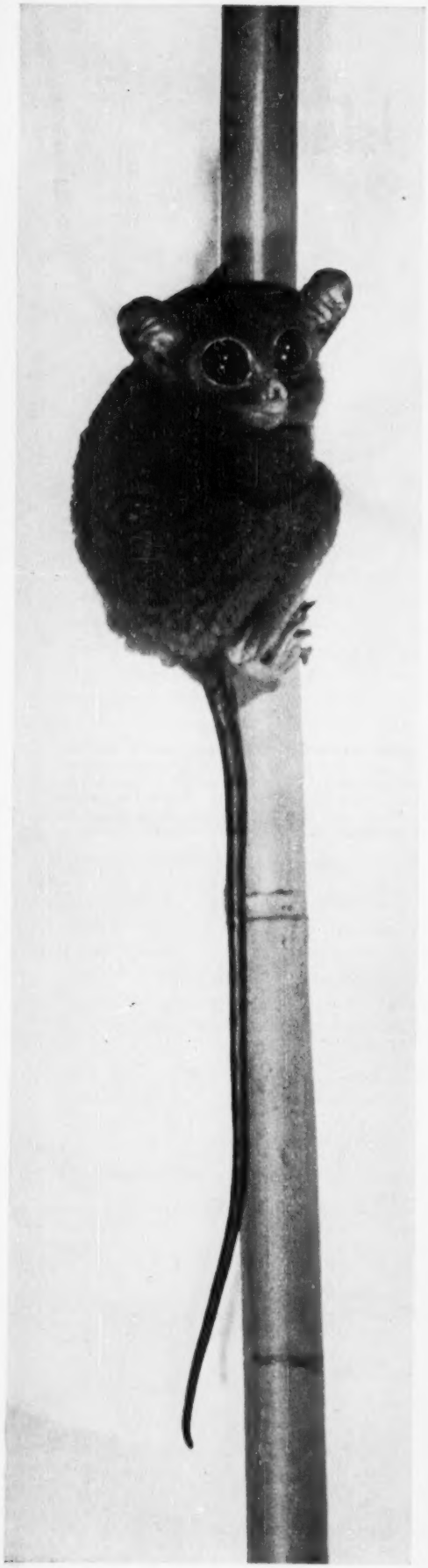
The length of the head and body is five to eight inches; the tail is eight to twelve inches; the weight is three to six ounces. The color ranges from buffy to grayish brown to dark brown, with underparts buffy, grayish or slaty. The tail is scantily haired, almost bare near the base, but more hairy toward the tip, with the end often tufted. The texture of the coat is woolly.

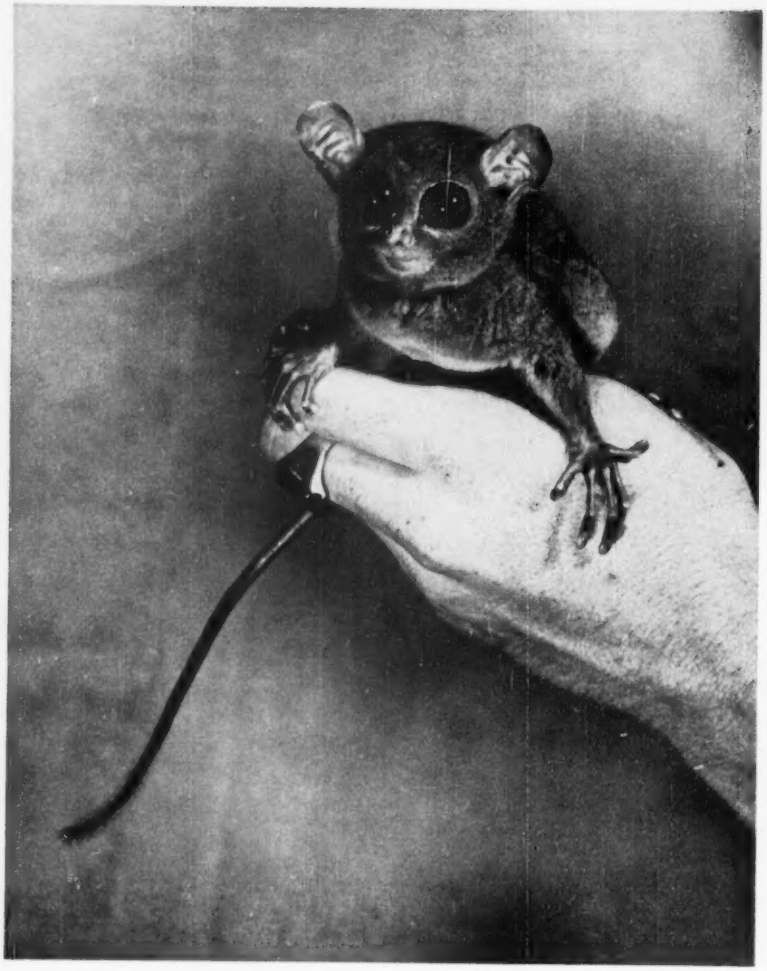
UNTIL August 9, 1947, when Charles Wharton brought twenty-eight tarsiers, of the species *Tarsius carbonarius*, by air from Mindanao Island, one of the Philippine group, few people had even heard of tarsiers, and only about six in all had been in the United States. These had been in private hands, or in laboratories. They had not been placed on exhibition, and lived only a short time. Tarsiers were no better known in other parts of the world, except in their natural haunts.

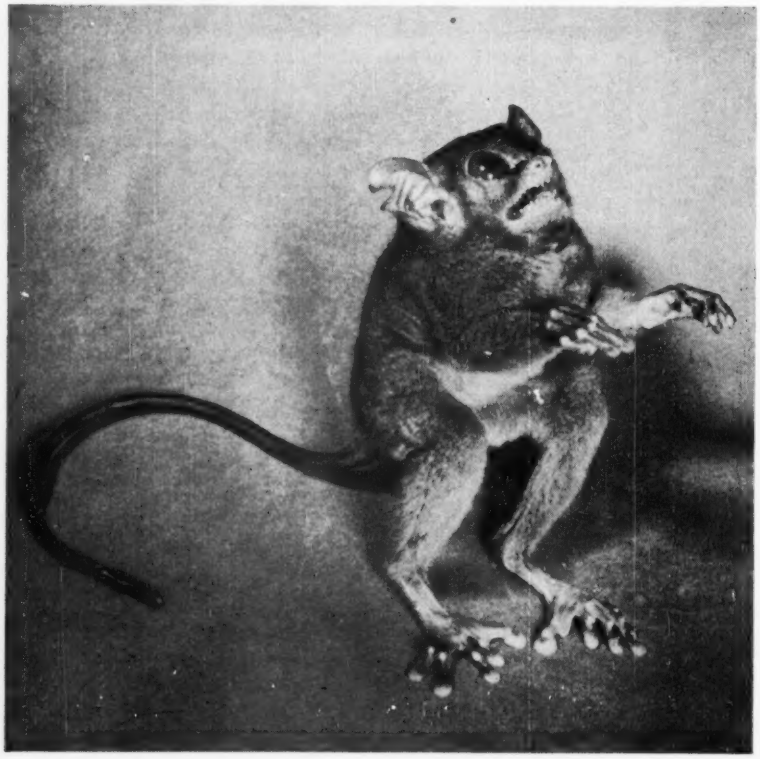
Mr. Wharton's specimens were exhibited in the United States National Zoological Park, sold to various zoos in the United States, the London Zoo of the Zoological Society of London, and to a research laboratory. Tarsiers made headlines and front page covers, so millions of people in the United States should now know them by sight and name.

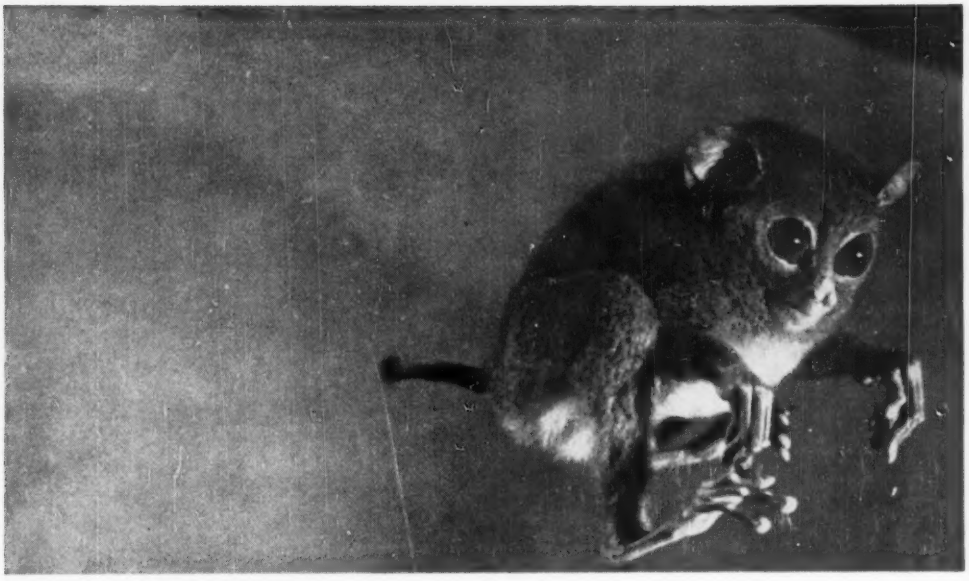
There are about seven species of tarsiers. Their combined ranges include Borneo, Billiton, Sumatra, Java and

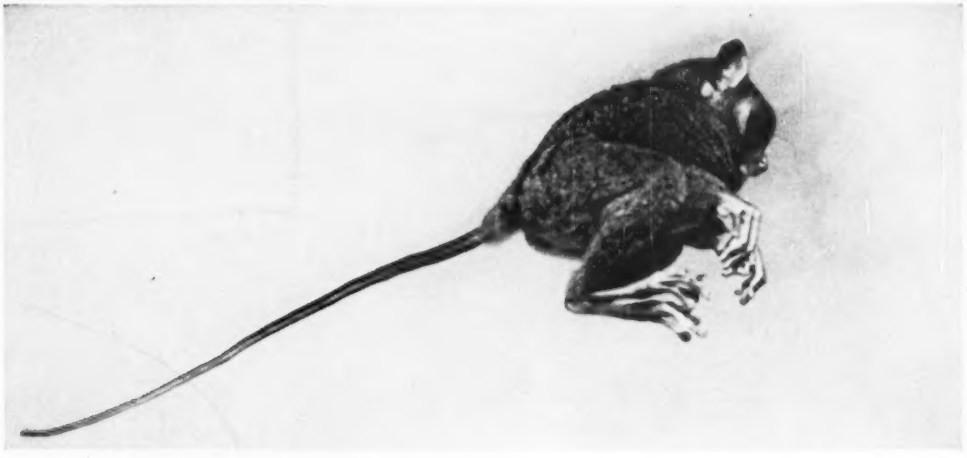
A tarsier is proferred a lizard but its reception of this dainty does not appear to be too enthusiastic. In the wild these animals live largely on lizards and insects.



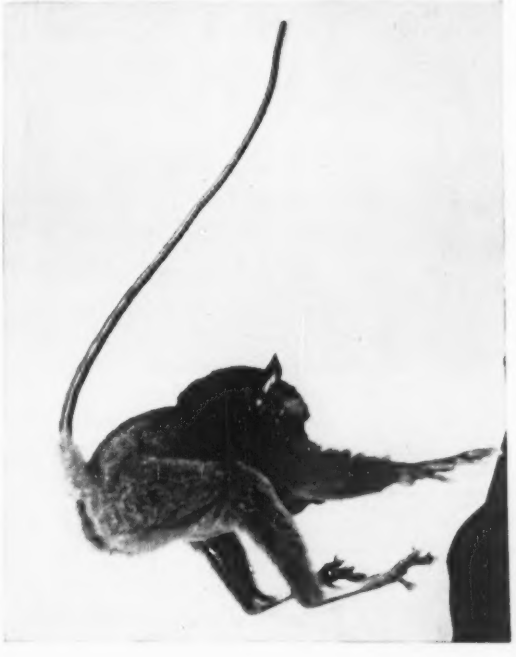








On these two pages are several interesting studies of tarsiers. Opposite, one of the little animals clings to a pole. The long and slender legs and arms of the tarsier have long and slender toes and fingers, tipped with large, fleshy pads that give the animal a firm grip on almost any surface. Opposite, above, is a tarsier in hand, showing its relative size. Opposite, below, a tarsier stands on its hind legs. They sometimes jump about in this way like a kangaroo or kangaroo rat. On this page we see a tarsier jumping, in air and about to land. They can travel by powerful leaps over considerable distances



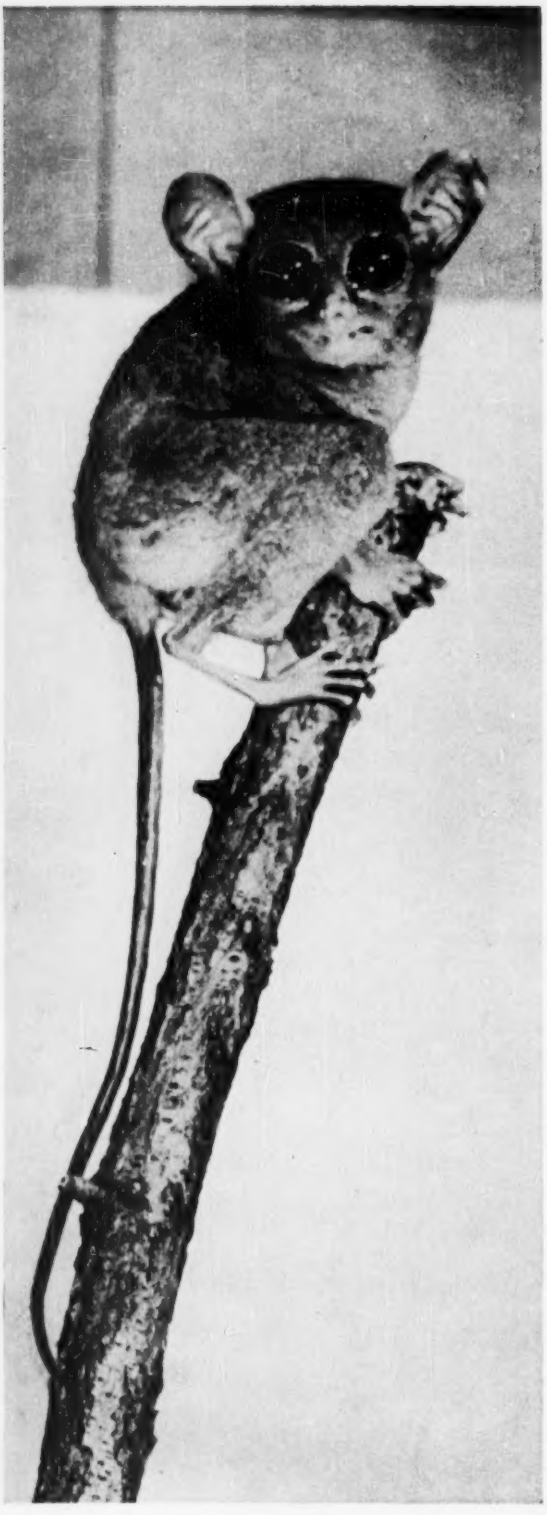
Celebes in the East Indies, and Saniar, Leyte, Bohol, Mindanao and Shanghir of the Philippine Archipelago.

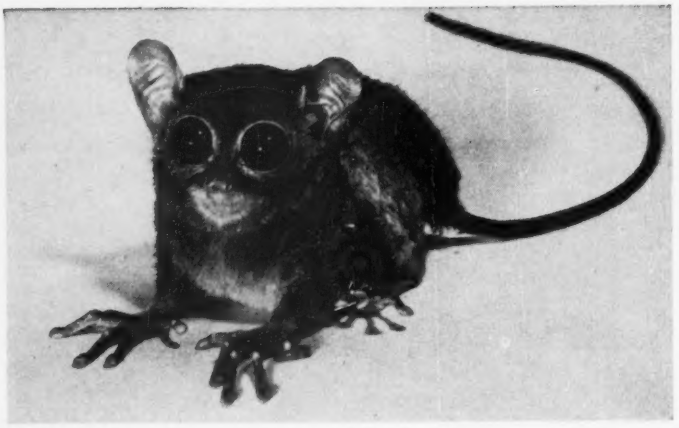
They are creatures of the tropics and do not range far up the mountains.

During the day they perch and sleep in dense vegetation within a few feet of the ground. When darkness arrives they awaken and start in search of insects, lizards, fruit and bits of tender vegetation. No doubt they capture small birds and they probably help themselves to birds' eggs.

Tarsiers should be delightful little pets if obtained when young and treated kindly. One person who had a pet stated that it would creep about him and lick his skin.

Only one young is usually produced but occasionally there are twins. The newborn young of the Bornean tarsier weighs slightly more than three-fourths of an ounce.

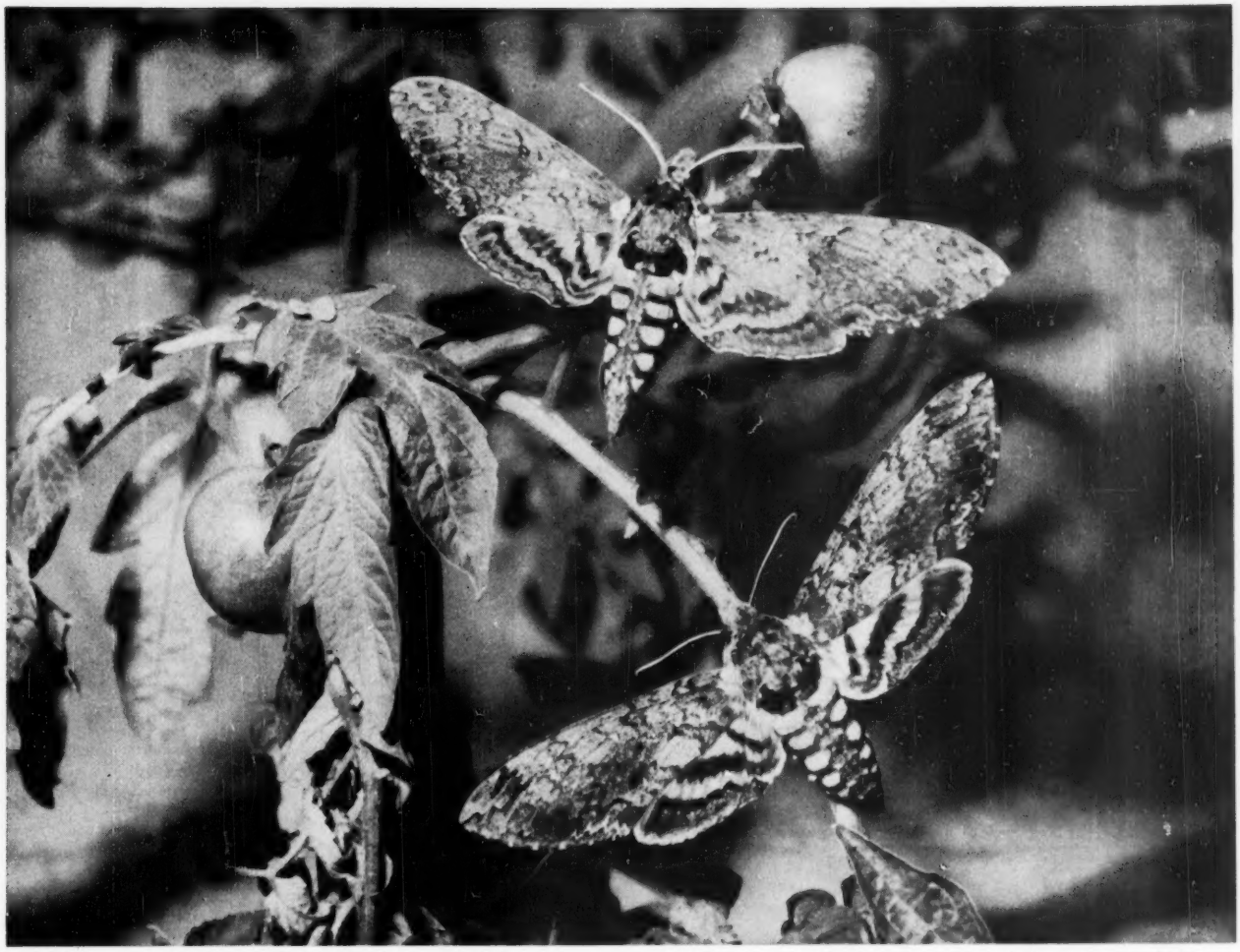




They are so strongly nocturnal that people who would want to keep them for pets should reconcile themselves to the fact that they will only be active at night, in subdued artificial light or during very cloudy days.

There are many peculiar native beliefs regarding tarsiers. One states they live on charcoal. Another belief is that the eyes of tarsiers are beneficial to people with eye trouble.

Above, and above right, are two excellent views of the tarsier's eyes. Nocturnal animals, during the day the pupils are contracted into tiny, vertical slits. The animals are then inactive. At night the pupils open into large circles and the tarsiers become animated, active and interesting. At the right the pads on the hands and feet of the animal are well shown.



Two mounted specimens of the tomato sphinx moth, *Phlegethontius sexta*, posed on a tomato plant, the male above. Below, the egg, which is oval to spherical, generally greenish-white and deposited, usually singly, on the lower surface of the leaves, although now and then on the upper surface. Incubation is from two to seven days.

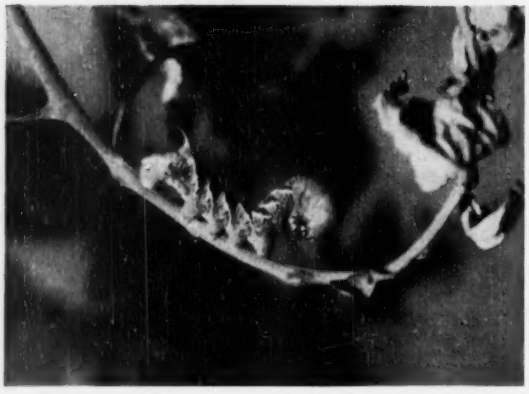
The Life of the Tomato Moth

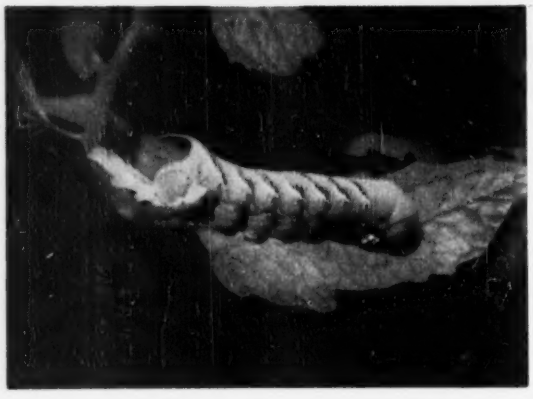
AS RECORDED BY LEE PASSMORE

THE tomato sphinx moth is one of the most destructive insects among the moths. A United States Patent Office report for 1847 speaks of the ravages of this insect upon the tobacco crop, the leaves of the plants in many fields being stripped by the larvae. As early as 1850 an enterprising planter engaged in the cultivation of tobacco experimented with methods designed to control this insect. These methods consisted of inserting various poisons into the flowers of the jimson weed, the favored plant of the adult moth. These poisons included copper sulphate, cobalt and crude arsenic. By 1873 the Department of Agriculture was receiving many requests as to the best means for controlling the insect.

This moth is distributed throughout the United States South America, Mexico, and the West Indies, and ranges, into Canada. There are, however, no records of its occurrence in Europe, Africa or Asia.

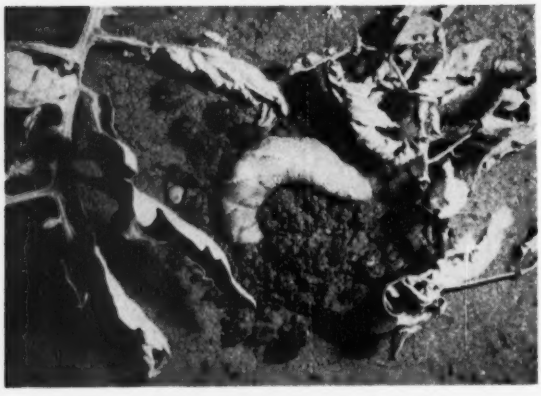
The food plants of this moth, in its larval state, are tomato, tobacco, potato, egg-plant, peppers, and all other Solanaceae. The earliest appearance of the adults is usually from the middle to the latter part of April, while the latest occurrence in the fall is from October to November. The seasonal abundance of all stages usually reaches a peak during July. The average life of the female moth is seven days, while that of the male averages five days. The sex ratio is about equal. The adult moths are active only at night. Observations indi-

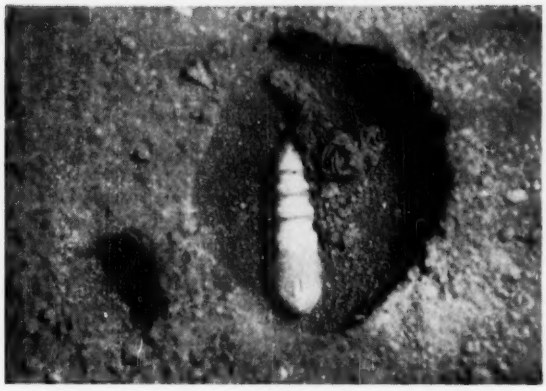


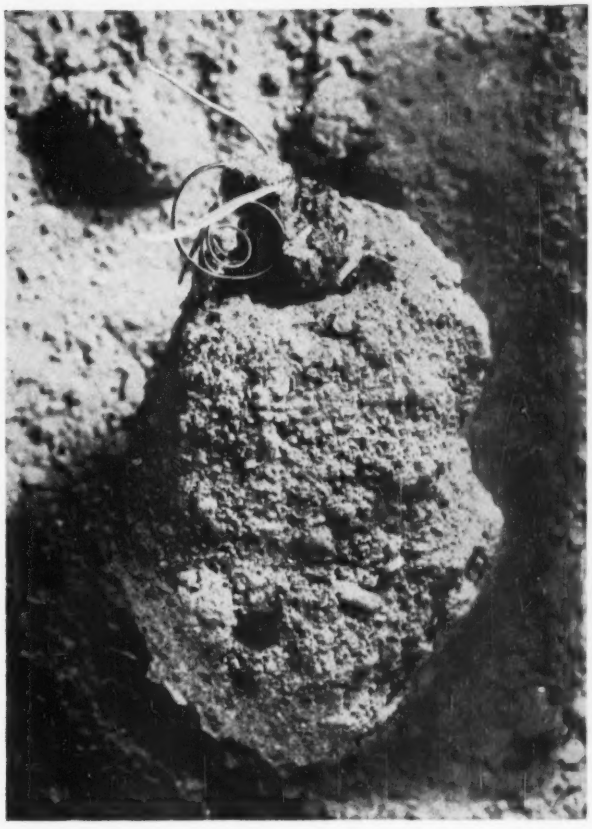


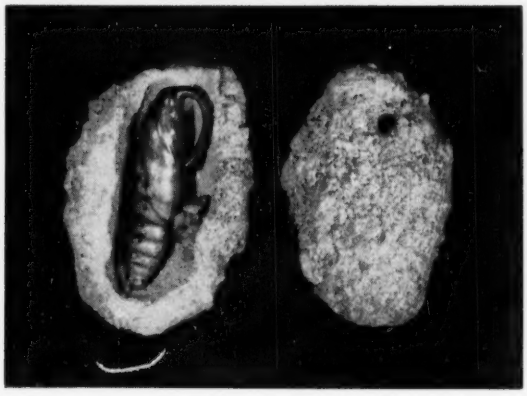
The larva above has just shed its skin, seen on the stem below the anal horn. The caterpillar feeds on the leaves continuously, save for about four 24-hour periods, when the skin is being shed. Below, the leaves gone, the larva turns to eating the fruit of the tomato plant.

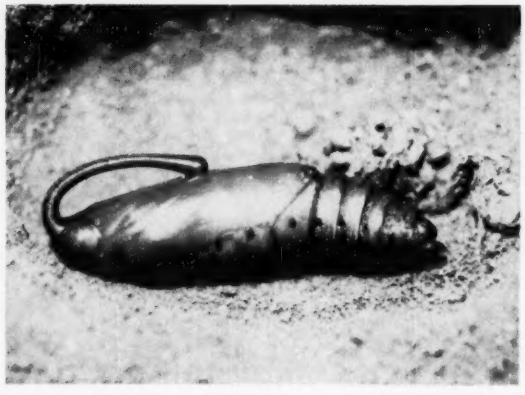
Newly hatched larva, left, is about three-sixteenths of an inch long. It is yellowish white, turning to pale green after a short feeding period. Then the oblique black and white stripes appear. In about three weeks the larva grows to about three and one-half inches. Next below, left, a larva has raised its head. At the right a full-grown larva that has eaten all the leaves. Next, below, it has eaten many times its weight and is about ready to burrow. Next, below, a larva about to enter the pupal chamber and has emptied its alimentary canal. The pellets are around it. At the bottom of the page, the egg-shaped cell of the larva, about five inches deep.









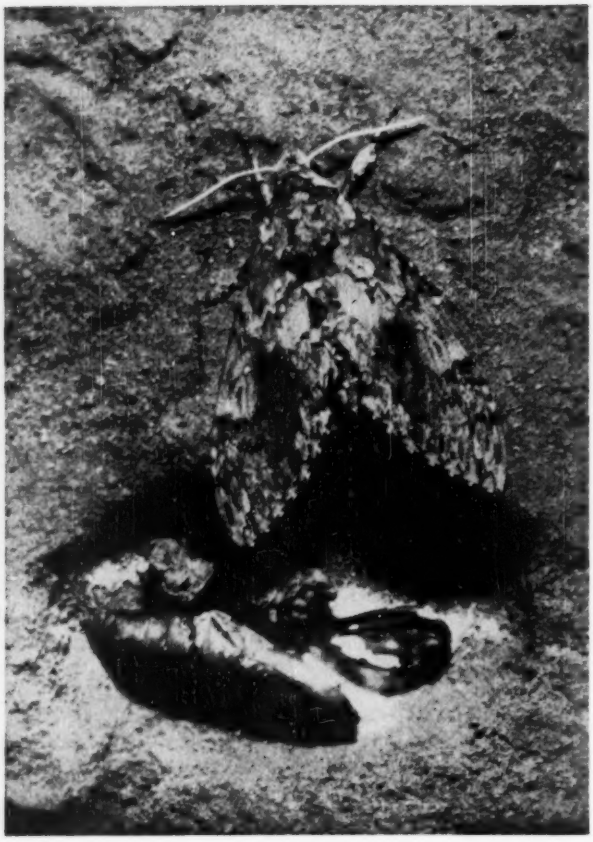


Five more events in the life cycle of the tomato sphinx moth. Above, left, about seven days after the larva has gone into the pupal stage it has already started to form itself into a moth. These are minute beginnings of wings, legs, eyes and the odd proboscis, or tongue.

Next is a pupal chamber removed from the ground and bisected. The pupa and the skin shed by the larva are found in the chamber. The pupal stage is spent at a depth of five or six inches below the surface, and may be for two or three weeks in the summer or for the entire winter.

Above, right, is a pupal chamber removed and kept under observation. At last the earth at one end of the chamber fell away and the head parts of the moth appeared. First came the antenna and then the whip-like tongue. The latter had been withdrawn from its case and was about three and one-half inches long.

At the right, the moth out of its pupal stage. The wings, at first, are short, thick and wet. The abdomen, with its six pairs of orange-colored spots, was soft and flabby.



Above, the wings are increased in size by blood being pumped into them. When fully expanded and dried, they rest roof-like over the abdomen. Above, right, we see the long tongue, which consists of two sections so joined together that the groove on the inner side of each forms one half of the hollow tube they jointly make. Through this organ the insect sucks the nectar from flowers.

At the right the tongue is coiled like a watch spring. The compound eyes of the moth are adapted to seeing in the dim evening or morning light. The eyes are composed of many hundreds of units, each with its own condensing organs.

cate that they mate only once. The number of eggs laid averages 254. The incubation period is about five days. The total length of the development from egg to adult averages one hundred and sixty-two days.

The Incas of South America developed no written language, and in consequence left behind no records. They, or their fore-runners, however, developed the potato and tomato plants. Thus it is quite logical to assume that they were fighting this insect pest down through the centuries, while the Europeans were yet living in caves. Consider the damage caused by this insect in one season and multiply this by the centuries, and the total staggers the imagination. Today the methods of control have greatly improved in cost and efficiency. Thousands of acres of the plants are annually dusted by airplane and other mechanical means.

A young meteorologist and a group of soil testers work side by side.

Youthful geologist in a brown study over a problem in rock classification.

Nature Study—Aid to Mental Health

By DR. ERNEST HARMS

TEN YEARS ago I started Broadview Farm Camp at Pittsfield, N.H., in the foothills of the White Mountains, as an experiment. Its aim was to develop a summer camp that would supply children with means to a real, full and satisfactory adjustment to the world and life missing from existence in large urban communities. In the years since I have found that a well-guided introduction to Nature itself is the best possible start for a child's happy adjustment to the rest of the world.

I have always considered Nature study a more important part of education than any of the subjects taught in most modern schools. So daily Nature walks, together with some kind of Nature study, were part of our program from the beginning. And many camp experiences stressed the unique importance of Nature study for camp work, especially in relation to physical and mental health.

During the second camping season, a father came to us to enroll his nine-year-old daughter. He was apologetic because she was a year and one-half behind in school. We found the child to be only a little shy and insecure; a badly frustrated Cinderella who proved to be an easily guided and well-behaved youngster. At first completely helpless without the strict rules of home, she was nevertheless eager to participate; and at the first opportunity she enlisted voluntarily in a Nature study walk. My experience with that child was one of the most amazing in all my work with children. She remained close by my side throughout the walk, absorbing everything with intense attention. When I asked her to identify again plants that had been pointed out earlier, she not only never failed, but, without being asked, pointed out different plants of the same family. She was as quick as any adult could have been to recognize special similarities in the botanical world, and to understand general differentiations and the processes of plant growth and reproduction. Moreover, during her stay at the camp she followed this study with the seriousness of a graduate student. I have a duplicate of the herbarium she made for me, which I cherish as one of the most precious results of our work in Nature study.

The discovery of this unusual botanical ability was only the outward aspect of the change in this child. Far more important was the complete change in attitude, in personality, and in learning ability that was brought about by finding a deep and satisfying interest in the world. Her shyness disappeared completely; she became an outgoing, self-confident, and intellectually almost precocious young person. And once established in her inner security, with the proper cooperation of her parents, she carried on her school career as a student always ahead of her class.

As a result of this experience, I became as keen a student of Nature for its value in the development and mental health of children as my little botanist had been for herself. We started intensive experimental work along this line at once, by building a Nature House, and by hiring staff members exclusively for the purpose of teaching the children about Nature.

It was another experience, however, that brought the

The "Science Board" is the social center for all the young scientists.

scope and possibilities of the program fully to my attention. During the winter a twelve-year-old boy came to the guidance clinic, of which I was director. He had suddenly started to have nightmares about earthquakes. They aroused fear of such intensity that it carried over into his waking life. He begged his father to purchase a seismograph and to take the family away from the city. His parents consulted a psychiatrist who diagnosed the dreams as symptoms of approaching maturity, and gave the child a fireside chat on the functions of masculinity. This, however, did not cure the condition, and the child was brought to us.

The first interview was enough to persuade me that Freudian psychology alone would not provide the answer to this case. It developed that the boy had recently read a juvenile version of *The Last Days of Pompeii*, and about the same time had seen the impressive movie, *Birth of A Volcano*. The combined impact of these, and one or two slight accidents that had befallen him, resulted in the severe trauma that gripped him now. There was no question but that he was in need of psychotherapy. At our second meeting he gave me a clue as to the kind of therapy that would help him most. "If we have weather forecasting," he said, "why don't we have earthquake forecasting? When I grow up, I'm going to build a kind of seismograph that can tell an earthquake *before* it comes." This interest made it evident to me that Nature study and information about earthquakes and their causes could play a major part in helping him mentally.

We do not accept any sick children at Broadview Farm; but this lad made such astonishing progress during his visits to the clinic that I decided to take him to the camp in the hope that a long and intensive period of Nature study might free him completely from the disturbance. He proved to be fascinated by the geological and mineralogical information that the camp instructors gave him, and he absorbed it as with a much-needed food. The nightmares stopped miraculously. One day, when we were inspecting a quarry of igneous rock, he came up to me and said, with a smile, "I guess we don't need to be scared of earthquakes at a place like this." The neurotic spell had been broken. We sent home a youth who was not only completely recovered from his mental disturbance, but who felt secure about the world in which we all have to live.

The point to be emphasized here is that knowledge of the world he lived in meant for this child not simply a collection of facts, but a basic feeling of familiarity and security about our existence. And what was true for this boy, whom events had hurt somewhat, is also true for every young child. Young children do not desire information about the world simply to add to their fund of general knowledge, as we do. They need it primarily in order to feel secure. The endless "why"

Youthful botanist deep in a study of the mystery of growth.

of children's questions is the expression of this need, which is as basic to their development as their food.

Despite the great advances made by child psychology, little has as yet been done to give parents the real information necessary to provide the kind of knowledge about the outer world that their children demand. Usually parents think of these questions as infantile imitations of adult ones. In reality, children ask questions, and demand to know "why," from an innate personal need. This is much deeper than, for instance, the "interest" that makes an adult a specialist in this or that field. The degree of a child's fear, or his feeling of safety, depends on what he knows. This is why the answers to his questions are often taken more seriously than we expect, and he sometimes startles us with the tragic intensity of his despair over some-

thing that seems to us completely inconsequential.

An incident that occurred at camp last year will serve as an amusing illustration of this. A young mother brought her little five-year-old to camp, and in order to reconcile him to leaving her, she glowingly described the animals and all the other delights in store for him. His eyes shone with anticipation, and he was beaming when his mother said:

"And if you're a good boy, some day you may even be allowed to milk the cow." At once his face clouded and he burst into tears.

"Why, what's the matter?" asked his astonished mother.

Still sobbing, he answered, "When the milks starts to come out, I won't know how to shut it up!"

This little story illustrates two things — how serious children are about what they do not understand, and how unrelated the city child is to natural facts and processes. Child psychologists are aware of these things, but the average school does not deal satisfac-

A young weather forecaster interprets the message of his self-made equipment.

torily with them. Nature instruction for children is usually a watered-down version of adult science, and classes are too large to take care of the individual needs of each child.

The task that I set myself at Broadview Farm was to discover instruction that really responded to the mental needs of children. It is not only the hurt or difficult child who has these needs, but each and every child. Of course, there are many camps that include Nature study in their programs, but this often amounts to no more than an extension of the science taught in school, or is a form of recreation. At Broadview Farm, the entire camp is devoted to Nature study for the compensations it provides. Our location is remarkably rich in Nature study resources. There are wild woods, a lake, brooks, and swampland, and an astonishing

A simple barometer made from handy materials, but it really works.

number of unusual flowers, as well as wildlife (including beavers); and we have counted nearly seventy different kinds of birds.

The farm, as such, is not run on a producing basis, but is arranged to give children as much practical experience with animals and growing crops as they can absorb. Aside from farming and the Nature study program, we have on hand materials for work in every field. There are opportunities to learn to use mechanical and electrical instruments, and to do simple handicrafts. We describe to the campers all the things they can do, and try to bring them together into groups to work on various projects. Most of these projects go on during the morning, but specially interested youngsters are given time for further work on the subjects.

The technique of supervising any project is not to teach the children in the sense of lecturing to them, but to answer the questions that they may have on their minds — or in their hearts — and to meet, as far as possible, the problems arising from them. One of the essential factors in giving children the information they want is to adjust it to the language and way of thinking of the various age groups. We do not designate subjects by scientific names, such as astronomy, meteorology, geology. The children learn about the stars, the weather, the rocks and minerals; the earth, plants, birds, mammals or insects; bones, or the human body.

Although we give our campers complete freedom to change from one project to another, if they like, we find that almost all have specific problems they want to study and work out in their minds. Of course, there is no rule to explain why a seven-year-old would rather study stones than butterflies, or why an adolescent girl would rather watch the stars than the birds. In many cases personal experiences rule choice.

Such an experience, although in a negative form, determined the choice of an engineer's son, who had been sent to us by his father because he was "unable to make up his mind what to do." The boy had been fed mechanical and technical details by his father until he was almost sick of the diet that had been forced upon him, and was happy to be at camp away from his father's pressure. For a few days he puttered around the Nature House, but found nothing to do, preferring to take walks by himself. Then one day he came across a soil-testing kit that drew his attention. He immediately set intensively to work with it, and produced some of the most original work of anyone at the camp. It kept him occupied until the end of the season, and a few months after his departure I received a telephone call from his father to thank me for what I had done for his son. It seemed that his work with soil-testing had led him to decide finally upon chemistry as his vocation. This was not exactly what his father had expected, but he was content that we had given the boy the opportunity to straighten himself out and make a clear — and free — decision.

But vocational or parental pressures are not the chief cause of our children's confusion. The educational steamroller in our schools has a much more serious effect upon innumerable children, who have information forced upon them that they do not need and do not want, while their own problems and interests are suppressed. We ought to think more often about the effect that this type of education has, before we go on to wonder why we have these nervous, dissatisfied, and unhappy children. Of course, schools alone cannot be blamed for this method since our whole civilization tends to force upon us things we do not need or want, and to disregard or suppress our individual needs and desires. Nevertheless, giving children the chance to get the scientific knowledge they really want, at the time when they want it, will be a great contribution to their mental health, and eventually to their adjustment to modern civilization.

Naturally, the inability to satisfy their personal need for information is not the most serious problem in the lives of all children. The troubles of a broken home, or financial distress, may be much more devastating. But there are many children whose parents have never realized how much they would be helped educationally by the opportunity — either at home or during a summer vacation — to get the information that satisfies their needs. If more young minds were occupied with the problems that really interest them, outside factors that might otherwise disturb their sound development would be combatted and eliminated. We must learn to understand that the scientific and natural bases of the world are not only a physical factor in our material lives, but also a psychological one in the mental health of ourselves and of our offspring.

Arizona's Tree Cactus

By NELL MURBARGER

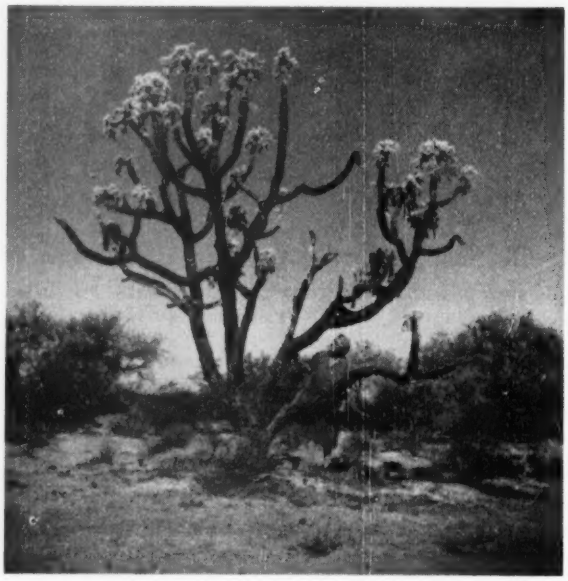
Photograph by the Author

Among cactuses of the southwestern United States, only the giant saguaro is taller and of more outstanding appearance than the candelabra cactus, *Opuntia fulgida*, which has been known to attain heights as great as twenty feet.

Frequenting the hottest, most arid sections of Arizona, and penetrating south into the Mexican States of Sonora and Sinaloa, this giant species is known both for the viciousness of its spines and the beauty of its wood skeleton.

In living specimens this skeleton is hidden beneath a layer of soft, green flesh. With death of the plant from storm, old age or other causes, this succulent covering slowly decays or is nibbled away by desert rodents, at last leaving exposed a beautifully honeycombed wooden cylinder, so hard it can scarcely be whittled with a knife. From well-preserved sections of those skeletons, desert craftsmen construct a wide variety of items, including chairs and other light furniture, lamp standards, picture frames, trays, and sundry gift items.

Despite the plant's large size, its blossom is pale and insignificant, and its small seedy fruits are sour and unpalatable to any save the wild creatures of the desert.



The candelabra cactus, or tree cholla, here photographed in Sonora, Mexico, is one of the outstanding growths of our hottest and most arid desert areas.

The author's cabin in the British Columbia woods in winter; the Eden that was created with loving hands — and lost.

Lost Eden

By GILEAN DOUGLAS

THIS is a pleasant place. Salt winds move through those fourth-growth evergreens that have escaped the logger's power saw, and salt water murmurs or shouts at my front door. My house is large enough for duties and obligations, although adventure would feel cramped between its plastered walls. There are neighbors and community affairs and church for the going. At evening sunset streams saffron and rose above snow-capped mountains of the Coast Range, fifty miles away.

I have learned in the last five years that it is not wise to look too closely or too long at those high peaks, especially if an olive-backed thrush is singing good-night. Neither is it wise to walk through the woods of early morning when a song sparrow is hymning the sun. Better, far better, to talk, to smile, to shorten the zestful stride to steps as decorous as any mourner's. Better, perhaps — but not always possible, for who has ever gone back to Eden?

Suddenly a wild pink currant blazes out of April, or a varied thrush chimes through the rain song of November — and I am back in a valley of the Selkirks, mountains and forest all around me and a wild river tearing through them. I am back where I spent the seven happiest years of my life, and, for as long as it takes to dream that time again, my *heimweh* (that longing for the home of the heart) is hushed and I am as warmly, deeply joyful as a summer wind.

It was summer when, fishing the Rinn River in British Columbia, I spied the silvery shake roof of an old cabin above tangled masses of thimbleberry and devil's club. As surely as Brigham Young thought God said to him, "This is the place," something in my heart said that to me. The place for which I had been looking all my life. El Dorado, Shangri-la, Eden, home.

During the next few weeks I worked at a gallop; acquiring the land, buying and packing in supplies, clearing the trails through the valley. It was only a small valley; five acres of gravelly soil which stood twenty feet above the river and had once been its bed. The cabin had one room and nine windows. It was cobwebbed and dirty, smelling high of mold and mouse. There was an ancient stove, an oil drum heater, two butter box chairs, a bench, a table and a kitchen cabinet. All these were hand-hewn, as were the fir floors, the small porch, the cedar walls.

Outside, at the edge of the forest, stood a well-stocked woodshed. The land nestled in the curve of the river, which bounded it on two sides. On the third side were woods and mountain, on the fourth mountain and canyon. Two tall firs and a big cedar stood singly at the edge of the clearing near the Rinn; each straight and unbranched for almost 100 feet and looking, when transformed by moonlight, like palms on a tropical shore. Stumps of even larger trees, which could be hollowed out as flower beds, stood here and there. The bush came almost to the walls of the cabin, which had shake walls with bark tacked to one of them. There was only one door, which gave on the tiny porch facing the forest.

Two paths led down to the river, and a third into the woods. There was no bridge across the Rinn, but there were two strong cables with a cage (boards nailed together and suspended by wires from bearings running along the cable) attached to each. The mail cable left a low platform on the cabin side of the river and ran "uphill" to another platform perched 14 feet up a big hemlock on the other side. The passenger pulled the cage along the cable by hand power. From each "out" platform a trail led through the forest towards the little

settlement some four miles away over the mountains. That was where my nearest neighbors lived, with a branch railway at their doors, but no road. In winter the railway closed down and, as there was no road of any sort for more than thirty miles, we were often completely isolated for months at a time; which pleased me immensely.

Wild berries were everywhere around the cabin: Thimble, strawberry, black, Saskatoon, blue and red elder, blue and red huckleberry, squaw, black cap raspberry, wild cherry, gooseberry, black currant, Oregon grape. There were hazelnuts, also, and from the cabin porch I could spot other edible or drinkable plants such as nettles, miner's lettuce, wild onion, mint, dandelion, fireweed, lamb's quarters, edible thistle, yellow arum, sorrel, sage, clover, camomile, snowberry, plantain, horsetail, shepherd's purse, chickweed, Solomon's seal, bracken, dock, black nightshade, Canada and sow thistle, burdock, kinnikinnick. During the years, I added some fifty more to this list, some of them higher up in the mountains and others a bit farther east and west, in the real dry belt country. I was in that strip called the interior wet belt and so had triple blessing in arid, moist and sub-alpine flora and fauna.

The mountains reared abruptly not far away, with, nearer, two tall firs and a cedar.

They say that only the homeless can appreciate home and I had been homeless for years. There had been plenty of roofs over my head, but none of them were my own and nowhere could I remember more than a flowerpot of earth that could truly be called mine. Now there was a cabin to build into my heart's desire. There was soil to be worked with as my partner of living. There was a river for pure water and power, and for those free, wild symphonies, which are to me the ultimate core of music.

There were mountains to climb, woods to walk in, miners' trails to follow, and if I wanted to shout in the morning, or sing out the day, there was no one to be angry or disturbed. Sometimes I used to burst out of my door in the first dawnlight and run around the cabin in sheer exultation because I was alive and there. Sometimes I would sit the night through under a big cedar by the river, feeling the Infinite soak in through pores of mind and body. I suppose it might be said that I was praying then.

But I prayed in more practical ways also — cultivating and feeding the impoverished soil, sowing seed, carrying water from the river, filling the woodshed, renovating the cabin, making flower beds, cooking and canning the vegetables and fruits of my labor. With some of this work I had neighborly or casual help, but most of it I did myself, and no one could have been happier in the doing. Every thrust of the spade, every stroke of the hammer was a thanksgiving hymn. And why not? Not only had I been granted all this beauty and good labor, but I had been given the rarest gift of all; the ability to know that I was happy in this place at this very moment. Too often our happiness has no present tense, only past and future.

I was never lonely. How could I be with the river as my talkative companion and the mountains my guardians? Then there were the great trees of an almost-primeval forest — cedar, hemlock, Douglas and grand fir, and pines, which were my staunch friends. Foolish as it may appear to many people — and especially in this precise, material age — that is the way my natural neighbors seemed to me. And I wanted to meet more of them.

So I climbed the mountains to discover alpine lakes, more rivers, clumps or sometimes small forests of lodgepole and white pine, alpine

Shakes were carried with which to clothe the outer walls of the cabin.

fir, Sitka spruce, Engelmann's spruce, dwarf juniper, yew, white pine, yellow cypress, mountain hemlock, amabilis fir; with black cottonwood, aspen, red alder and willow along the river banks. Vine and broadleaf maples and *Cascara sagrada* are present too, with paper birch shining out here and there against an evergreen background.

Among these trees, or punctuating the green manuscript of alpine meadows, were the wildflowers. I found more than 200 different species, and there are probably half as many more that I did not discover. In spring the woods near my cabin were virginal with trillium, starflower, strawberry bloom, alpine beauty, fairy bells, with false solomon's seal and goatsbeard foaming at the edge of forest green. *Calypso* sprang rosily from dark moss, and violets made golden pools and streams flow across leaf-mold soil. Banks of bracken or other fern — sword, shield, rock or maidenhair ferns made hanging gardens everywhere.

The edge of the forest started at the very door of the cabin; held many mysteries.

Then that aura of April, the wild pink currant, gave way to summer's purple fleabane and self-heal, orange honeysuckle, rosy twinflower, yellow avens, wild rose, foamflower, daisy, bluebell, yellow monkey-flower, syringa, blue beard-tongue and many more. Almost every walk meant a floral find. It might be Indian paintbrush or elephant's trunk from the fire-scarred hills; Indian pipe or pear-leafed wintergreen from the forest; blue-eyed grass, knotweed, rhododendron, heather (not the true heather, but a heath) from the high places.

With autumn the symphony of color quieted, but the many asters, thistles and goldenrods kept it from diminishing much. Blue mallow and ox-eye daisy bloomed gently beside loud hawkweed, hedge nettle and great mullein. Golden ragwort and yellow bur-marigold put sun where no sun was, with pearly everlasting standing moon-white beside them. A few mountain valerians could be found along the rivers, while clotbur, hedge mustard and lady's thumb seemed to be everywhere at once. The beautiful fireweed — also called willow herb and flaunting widow — was in its glory, making all places beautiful with its spikes of rose-purple blossoms. Later these would look like silver smoke blowing on the edge of winter, while below the moonwort (yarrow) shone star-pale.

And the birds. Long before the morning sun had topped my mountains, Whistler, my special hermit thrush, was repeating his melodious reveille over and over, punctuated with catcalls and snores for the morning sluggard. Then came the notes of the song sparrow and winter wren, like silver water running, and the robust chirps of various robins pulling early worms from my minute front lawn. Sometimes the varied thrush chimed from the forest where pileated woodpeckers and red-shafted flickers beat vigorous tattoos. Belted kingfishers and water ouzels called from the river, and bushes sang with warblers, those butterflies of the bird world.

Flocks of red-backed juncos, purple finches, golden-crowned and white-crowned sparrows, and white-breasted nuthatches passed through in April, as did some spotted towhees. My webbed-footed neighbors assembled in the big pool near my cabin before going up the river to nest. Golden-eyes, and harlequin ducks, and grebes and mergansers would be there, with flocks of teal and buffle-heads flying over. Along the shore teetered snowy and golden plovers, and the lesser yellow-legs (the famous "Alouette" of French-Canadian song) with perhaps a marsh hawk idling above them. Violet-green swallows and red-polled linnets hesitated

The cabin before completed, but after the kitchen had been added.

The River Rinn was not bridged but was crossed by means of a cage on a cable.

on their way to other places and sometimes a Tennessee warbler would give me a swift glimpse of his green and white self in passing, or I would hear once or twice the lovely descending trill of Wilson's thrush. Mountain bluebirds dropped down like bits of sky, and once a spectacular yellow-winged blackbird passed through.

The hermit thrush was summer, and so were the airy Vaux swifts, the darting hummers — rufous and calliope — the brown creeper and the modest warbling vireo. The red-breasted nuthatch and the chestnut-backed chickadee (they tell me that this is the only place in interior British Columbia where it occurs) were residents seen quite frequently, and various warblers — pileolated, lutescent, black-throated gray, MacGillivray's and Townsend's — went skimming through the underbrush at various valley and mountain altitudes.

Where the air was thinner I found, besides Audubon's and orange-crowned warblers, the redstart, Hepburn's rosy finch, mountain chickadee, cliff swallow, black swift, ruby-crowned and golden-crowned kinglets, Rocky Mountain jay, Clark's crow, white-tailed ptarmigan and that "singer at heaven's gates," the horned lark. From some high peak I would look higher yet to see the bald eagle or his golden cousin. Sometimes an osprey or a Cooper's hawk would follow the trail of my river.

The sparkling song of the white-crowned sparrow would greet me from clumps of ocean spray, and far in the forest downy woodpeckers and yellow-bellied sapsuckers drummed up and down the summer days. Rushing through the shrubbery below them, or freezing into small brown stones when danger threatened, went the Franklin and blue grouse with their watchful mothers. Nighthawks veered through the summer dusk as great gray owls and little pygmy owls tested the dark winds.

September brought Bewick's wren, cedar waxwing, tree swallow, vesper sparrow, with sandpipers on the shingle. That was when the little brown crane did most of his trout fishing and the ruffed grouse drummed as though it were spring again. Flocks of kinglets, nuthatches and vireos would still be blossoming the cedar trees in October and just before the first heavy snow of that month I would look up from cutting the last cabbages to see reflections of the deep autumn sky in the elder bushes with their last red berries. But a second glance told me that the heavenly images were only those raucous and earthy birds, the Steller jays. The black-headed grosbeaks came back in autumn, and later the pine and evening grosbeaks shone brightly against the snow. Pipits and pine siskins knew exactly when I had planted fall grass seed, and sometimes tree and fox sparrows would stop at my feeding station on their way south. Great horned and snowy owls were frequent winter visitors, also the black-capped chickadees.

On sunny October days there would still be butterflies in the garden — blue, white, swallowtail, mourning-cloak, marble, red admiral, tortoise shell. But no sign of the lilac sphinx or dark wood nymph of earlier days; or of the polyphemus or twin-spotted hawk moth, the purple copper or reaper-dart butterflies, or the dagger moth, which fluttered into the light of my campfires on mountain rambles.

Almost as beautiful as the birds and butterflies were the great blue damsel flies, humming-bird clearwings, and some of the beetles. Then there were the more soberly-clad sexton and engraver beetles, the ant lions, squash bugs, bee flies, inchworms, hover flies, spiders and the whirligig beetle, which spins such a delightful misty-silver cocoon. And of course there were snakes in Eden — mostly of various harmless garter varieties — and even salamanders. The real snakes — in the worst connotation of that word — were the slugs, cutworms, borers and aphids, which I fought for the lives of my vegetables and flowers.

So many more flowers, birds, (more than a hundred different species), butterflies, insects and reptiles than I have space to mention here! I have said nothing about the tree toads, or even mentioned the rocks that tell the age of my valley and its surrounding hills. I have said nothing about so many things that meant so much to me.

It was in winter that I used to go over my notes of such observations, listings, checking, correcting while the big snowflakes fell in the path of lamplight from my window and only the dark eastern side of tree trunks pointed the difference between white river and white mountain. That was when I could relax a little, with no outside work to do except snow shovelling and wood cutting; no visitors, no radio; just beauty, peace and contentment.

It is not quite accurate to say that there were no visitors. Wolves and cougars came close to the cabin, and whenever I went out on (Continued on page 215)

The Story of Nature's Soil

By J. DAVID LARSON

A field of potatoes growing in man-made Normal Soil, with the plants free of insect infestation without recourse to any sprays.

MORE than twenty-five years ago ill health called me from an engineering career to the family farm in northern Wisconsin. There I found physical tonic in the pure air of a forest area, and tonic for the mind in a complete change of scene. Hardwood timberland was being cleared for cultivation, with results that amazed me. I saw crops planted on newly cleared land, luxuriant and free from insects and disease. Then, the next year, I saw crops, planted on the same plots, attacked both by insects and disease, while crops on other newly cleared land grew unmolested. No amount of fertilizer applied during the second and succeeding years restored the initial immunity. In fact, fertilizer application on our virgin soil produced effects quite the opposite of expectation! What we expected from fertilizer application was increased, vigorous growth. We got increased yield, but not the vigor. This set the trend of my thoughts on a trail that was to lead to a then undetermined objective.

Agricultural authorities, practical farmers and others could give no reasonable explanation for this singular short-lived immunity. An engineer regards such mystifying phenomena as an engineering problem, hence solvable.

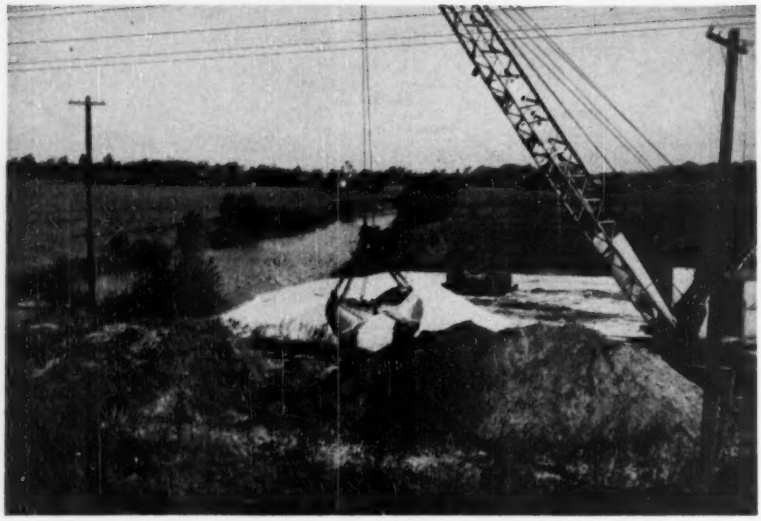
County agents and farm advisers either could not see the problem, or just did not care. This attitude merely whetted my desire for an answer. Here was no single riddle. The fertile soil yielded abundant, waist-high crops of clover, timothy and oats. They stood straight as soldiers the first year, on newly cleared land, despite buffeting by rain and wind storms. But when, the second year, and afterward, we fertilized hay and grain fields with barnyard manure — freshly spread, on advice of soil experts, to save valuable nitrogen — hay and grain was downed after each downpour, but did not straighten up as before. Why the tendency to lodge, as the farmer calls it? Moreover, why did our cattle spurn fertilized clover and timothy grass, preferring to graze wild meadow pasture? Again, why, in winter, did the cows gingerly sniff luscious clover and timothy hay piled high in their mangers, while eagerly devouring wild hay strewed in their stalls for bedding? These and many other practical problems on this pioneering farm launched me on a long-term program of basic research.

In our animal husbandry activities we blithely took for granted the exceptional circumstance that livestock remained immune to disease. No hog cholera — not even intestinal worms — afflicted the pigs. Chickens had none of the modern poultry ailments. Bangs Disease, or contagious abortion, bane of present day dairying, was wholly unknown in our dairy herd.

Primarily a grassland farm, where practically no grain was fed, we now recall the flavor, succulence and tender quality, with considerable nostalgia, of pork and beef produced on grass alone. An abundance of mineral nutrients in the soil aided health and resistance and likewise contributed to toothsome meat. Grassland farming is spreading today, a trend that is conserving topsoil and improving crop quality. This should enlighten those who dogmatically assert that unless animals are finished on grain, after grass feeding of young stock, the meat will be tough!

Mulling over the immunity led to the theory that, in virgin soil, Nature provided some obscure factor — a mysterious agent that evidently lost its force with the harvesting of the initial crop. More mature reflection convinced me that it was not just a single agent, but a whole host of topsoil minerals — *everything* needed for healthy, disease-resistant, insect-free crops. Further, and fully as important, the mineral nutrients were in a form immediately available as plant food.

Thus was born the question: Why not imitate Nature by actually producing virgin soil, a product containing a full quota of elements, all in the form of humus? This was enticing, but Nature takes from 400 to 1000 years to produce a few inches of topsoil. That is a long wait. There must be a short cut to imitating Nature's soil production process. Could it be that her raw materials, the primary rocks of the earth's crust, should be used, if crushed and reduced to small particles? This was a wise idea for, years later, chemical



This is not just an ordinary dredging operation, but a steam shovel doing its part in making virgin soil after Nature's plan.

A Hindu physicist named Raman discovered that when light of a single color is passed through a crude mineral solution, the rays were conspicuously scattered. A different scatter pattern resulted when light passed through mineral in solution that had been extracted from plants. Still a different pattern resulted when light passed through a mineral solution derived from animal tissue. Thus there is a difference between the inorganic and the organic states of mineral elements.

and spectrographic analyses disclosed the presence of trace minerals, among many other elements in the primary rocks. Thus we pioneered in this phase of soil nutrients, a phase now, at long last, being investigated at several great research institutions to discover the proper proportion of these micro-elements for topsoil application. Also it is now common knowledge that injudicious use of trace elements — in some cases only a few parts per million — can produce toxic effects upon plants and animals. In the primary rocks, however, Nature has wisely apportioned these catalysts, or minor elements, in the exact quantity needed for the production of healthy crops.

The toughest obstacle to be hurdled was how to transform rock material into available plant food, or humus. I sensed that transformation of crude mineral or rock material into humus meant not only reducing it to a *solution*, but also a fundamental change in its inherent properties. When iron, for example, is deposited within a plant cell, the element belongs no longer to the inorganic, mineral kingdom, any more than an adult, having passed through the portals of childhood, can be considered a child! Similarly, when inorganic mineral is exposed to partially decomposed organic matter, or humus, it is converted into plant food, that is, in a form readily assimilable by vegetation. If conversion of mineral into available nutriment for a plant cell is comparable to development of a child into manhood, then transformation of crude mineral into humus may appropriately be compared to adolescence! That this concept is no whimsey is shown by X-ray examination of minerals within plant cells, and by other laboratory tests, indicating that radical alteration of the crude mineral has taken place. The chemist and the physicist say it is "a change in lattice structure!" A clear realization of the significance of this change in lattice structure would correct a long-standing, erroneous tradition held by chemists that: "Iron is iron whether derived from the mineral kingdom, from spinach, or from animal or human red blood corpuscles."

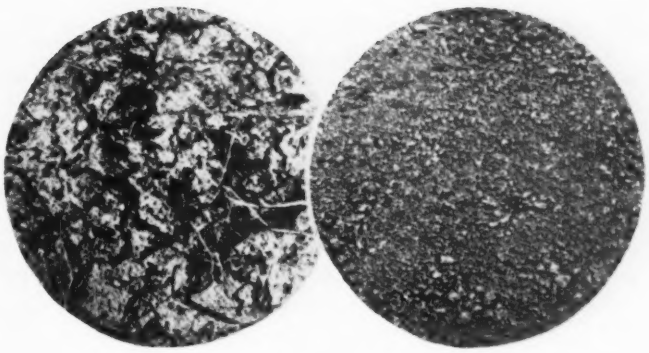
Plants are endowed with the capacity to discriminate between crude mineral elements and plant food in the humus state. That this power of vegetation to distinguish differences in the state of soil components must be a critically important factor in contributing to immunity of crops on the family farm during the first year of cultivation, was to me a foregone conclusion. This is merely another way of saying that the status of soil components exerts a profound influence upon plants.

To understand immunity of vegetation to attack by disease and insect pests, we must understand the distinction between *crude* and *organized* mineral nutrients. Forward-looking fertilizer producers today realize that application of raw chemicals to the soil leaves, in far too many instances, a residue of insoluble inorganic compounds. This indicates that a considerable portion of the fertilizer is not available to the crop. In contrast, organic fertilizer — plant nutrients in the form of humus — is completely available. Such plant food may not be wholly taken up by crops, but any excess over plant needs leaves no insoluble residues within the soil.

As a starting-point for production of a man-made virgin soil, it was necessary, first of all, to have Nature's original "blue print," or some criterion for a standard soil type. Conventional scientists had classified topsoil into several thousand different types. Could one hope to single out a universal pattern for primitive virgin soil? Then came the happy inspiration: Why not go to the source of all topsoil — Nature's primeval soil-production process?

In the beginning all soil came from the rocks of the earth's crust. Centuries of erosion, disintegration and decomposition crumbled those rocks into fine particles, assisted by heat, cold, sunshine, atmospheric electricity, rain, snow, bacterial action, and the carbon dioxide and nitrogen of the air. Along with this process came vivification of the disintegrated rock material! Crude mineral particles, exposed to decay of organic matter, were gradually transformed into humus, or available

At the left is a heavy clay topsoil as it is normally found, and, at the right, the same soil after Normal Soil has been added as a conditioner.



plant food. Where such humus, or virgin soil, remained *in situ*, undisturbed by landslide, earthquake, glacial drift, or other cataclysm, this complex of organic matter could be no other than Nature's own blue print for a *normal*, virgin soil!

Nature's pristine pattern of soil production indicated that centuries-long, imperceptibly slow organization of rock material into virgin soil was really a "slow motion" example of break-down of organic matter. Basically it was a fermentation process. Decomposition of organic matter in the presence of rock particles was, like compost-making, a process old as the human race. If, in converting rock material into humus, Nature employed fermentation on a long-drawn-out scale, a man-made virgin soil could be produced to a formula with specific proportions of raw ingredients, and through a cellulose fermentation process. Conversion of rock into an organic state, or humus, was the largest task. Initially, it took three years to perform this "miracle." With the discovery of new facts and more precise data about fermentation and bacterial action, it is now possible to produce virgin soil within a few days!

The application of our man-made virgin soil, or Normal Soil, to heavy clay topsoil, eroded of organic matter, showed amazing results. Where we first had to use a post-hole digger to make holes for planting potatoes, the heavy clay soon became mellow, friable, and tillable in all weathers! This soil-conditioning effect was regarded as of secondary importance to the increased yield of crops with extraordinary flavor and succulence. The demonstration of immunity was to come later, when the topsoil was *normalized* — saturated with an adequate quantity of our Normal Soil. Then, only, was such a soil environment created that each plant could absorb its normal, proportionate quota of organic nutrients, according to the individual plant's natural selectivity. This is in marked contrast to the forcing technique practised by greenhouse men and truck gardeners.

Following the ultimate saturation of our topsoil, a small quantity of Normal Soil was added each year to replenish minerals removed by crops. In this way an equilibrium, or backlog, of topsoil nutrients was maintained, and continuous immunity of our crops to disease and pests was assured.

So commonplace became our demonstration of immunity that, for several years, we took it for granted, ignoring its economic and "world-shaking" significance. Bombarded as we were by demands that we explain the mystery, it seemed wise to lift our soil rehabilitation program out of the realm of mere observation. We must evolve a sound theory to explain why insects refused to attack our crops; why we had no visitations of blight, rust, mildew, or other prevalent crop disease.

Biochemical facts about healthy plant development revealed that Nature had defense against attack, either by insects or by disease. This defense was *a critical proportion of soil components;* a *balanced* complex of mineral nutrients in the topsoil. Thus, any marked departure, or deviation from a *normal* virgin soil complex, was the primary factor disturbing or interrupting healthy plant growth. Such deviation changed the proportions of minerals in solution in cambial sap, which, in turn, predisposed the plant to unhealthy cell structure, and invited plant enemies. A well-fed child or young animal resist disease better than a poorly nourished individual, and so it is with plants.

"I never would have believed it if I had not seen it!" This spontaneous exclamation came from an executive of a well known agricultural foundation. Frankly mystified, he surveyed a most extraordinary scene. Fields of luxuriant potato vines, of tomatoes, cabbages, corn, beans, and other crops grew before him in great profusion, totally innocent of insecticide sprays and dusts. They were also free from attack by ravaging insects or by disease.

Among other things, the visitor saw, growing in man-made virgin soil, twenty-four long rows of tall, bushy, intensely-dark-green potato vines, some of whose basal leaves were no less than four inches in diameter! But along the entire length of one side of the potato plot he saw, growing in untreated soil, two rows of stunted, nondescript potato vines literally eaten up by swarms of Colorado beetles! On these vines he saw no evidence of insecticides, which was no oversight, but intended *to encourage* potato bugs to develop and to feed on the two rows of "unprotected" plants. It was also designed to prove that the bugs were not in the least interested in attacking the superlatively healthy potato vines immediately adjacent, and, quite as important, to convince doubting Thomases that isolation, or remoteness from infested plants, had nothing to do with immunity of our crops!

Gazing, wide-eyed, at this astounding demonstration, the executive remarked: "As a former county agent and farm adviser covering many States, never have I seen potato vines as luxuriant as these. What I can't understand is: Why don't the bugs attack these luscious vines? We have been taught that the more

luscious the food the more the bugs go for it."

This traditional viewpoint of biological science has led to confusion of thought among scientists and growers; a confusion that makes our story of crop immunity seem well nigh incredible. Typical of such chaotic thinking is a statement by an acknowledged authority on agriculture and horticulture, who said:

"Many insects are known to prefer healthy plants and will feed on the more vigorous productive plants and leave the weak, unfertilized plants alone. On the other hand, there are some diseases and insects that attack weakened plants, in which case any cultural practices which tend to produce strong vigorous plants will likewise help to control such diseases and insects."

This muddled, fatalistic philosophy implies that a grower must, willy-nilly, steer a course between the Scylla of weak-plant enemies, and the Charybdis of disease and insects certain to attack strong, vigorous crops. To extricate the farmer from the horns of this dilemma, orthodox science depends on poisonous insecticides, invariably reenforced by the direful warning that unless lethal sprays and dusts are used, the human race must starve!

Long ago, in our thinking, we discarded any idea that the basic factor of immunity resides in a specific material, chemical compound, or antibiotic. Important as antibiotics may be, *they are products of a chemical process.* As synthetic products, they cannot be expected to immunize against everything. Nor can anything expect to be so generally protective. Diseases and insect pests are legion, and insects are now breeding poison-resistant strains! A plant disease such as *rust*, alone may have 30 or 40 families of that single disease! Entomologists, plant breeders, and insecticide chemists are working feverishly to checkmate and circumvent insect pests and disease. To these workers the idea of a panacea is utterly incomprehensible. We would agree with this, assuming such an *hypothetical* specific is conceived to be a material substance; a hopeless concept, indeed! But there is a phase of the immunity problem that, to conventional science, is apparently still unexplored territory.

We have presented a mode of soil rehabilitation that shows extraordinary if not incredible results in counteracting pests and disease. So we ask, does the problem of immunity boil down to production of a soil that combines the properties of an insecticide, a fungicide, and a parasiticide? To clarify the inquiry, let us recapitulate. Attention has been focussed on: 1. A critical proportion of major and trace elements. 2. Nutrients in the form of humus, immediately available plant food. 3. An appropriate vehicle embodying these factors — our man-made virgin soil, or Normal Soil. Aside from the important premise that for an individual situation there must be intelligent application of such soil, is this as far as we can go in explaining Nature's basis for immunity? By no means, for up to now we have touched no more than the fringe of the *principle* involved; described merely "the outer garment" of that principle which is life!

Here is no delving into abstruse metaphysics, but only *applied common sense.* We now raise our sights to facts too long overlooked because of a rigid adherence to tradition. Let us remove traditional blinders and have a look at the *unexplored territory.*

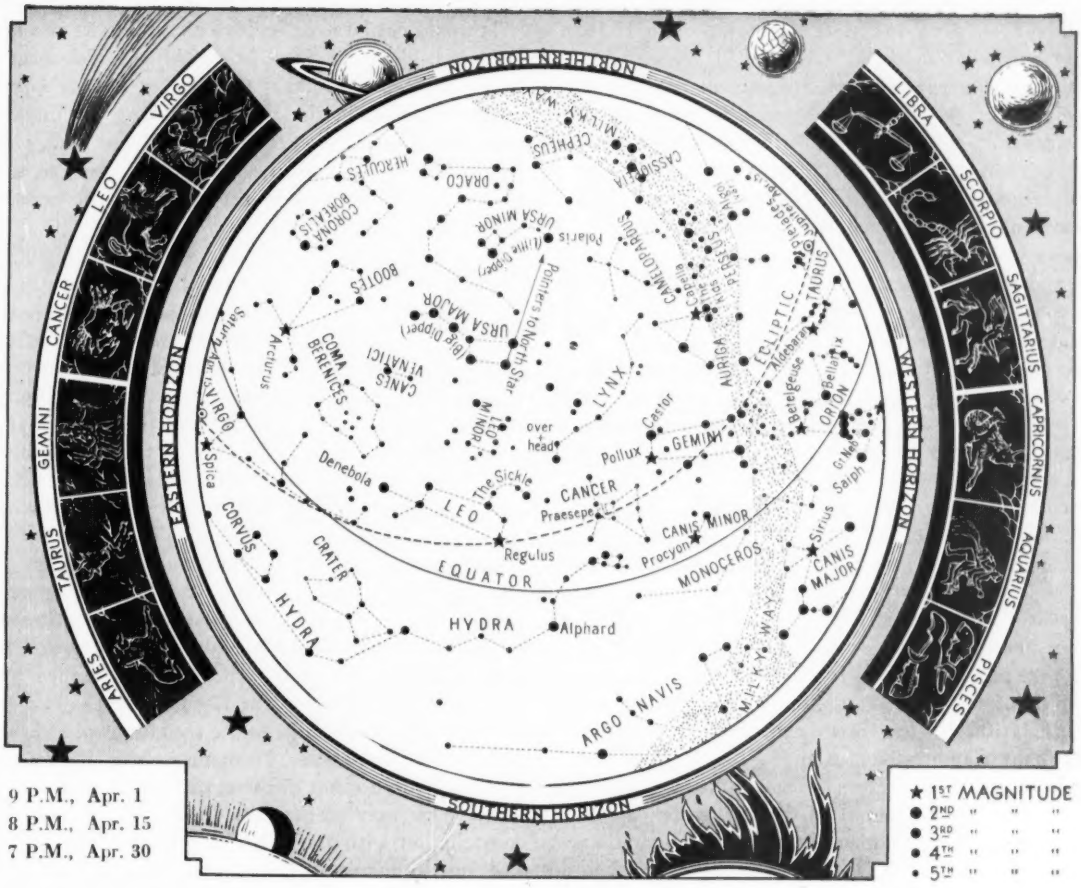
Life constitutes the basic principle in Nature's manifestation of immunity. It runs the entire gamut of protection against insects and disease. It does this because life, the subtle, vital energy animating plants, animals and man, is the mightiest force in the universe. Therefore, when the correct blend of physical material substance is present, as in Normal Soil (a critical proportion of major and minor nutrients), life exhibits itself in healthy vegetation. The plant, it must be understood, is not life, *per se.* Our reference to "the mightiest force in the universe" is no loose figure of speech, but a positive fact. When the proper physical and material conditions are at hand, as in healthy protoplasm, no destructive force can oppose the constructive manifestation of life! Contrariwise, when there is an *unbalanced state* of material substance, as in sickly protoplasm stemming from an unbalanced soil; when cambial sap, cell structure and other plant tissues have deviated from the normal — the result of a perverted status of soil components — disease and destructive insects automatically appear. Organic chemistry supplies facts relating to healthy and to unhealthy soil and plant constituents illustrating such conditions.

Perhaps conventional science is now on the verge of considering favorably the critically important, indeed, the indispensable role of the life principle. Not long ago the head of the Chemistry Department of Princeton University, addressing a Meeting of the American Association for the Advancement of Science, predicted that, in the next twenty-five years, scientists will devote more time and effort to investigate the life principle than has been done in all past history. Perhaps our brief reference here to the life principle may give impetus to organizing a new approach to the solution of the problem of insect pest and disease control.

In a foreword to the U.S.D.A. Yearbook, *Insects*, Charles F. Brannan, declares that harmful insects "are estimated to cost us four billion dollars a year." He refers to the "need to push on to new horizons of thinking and investigation, and, reaching them, seek newer horizons."

Throughout the more than 800 pages of this volume, *Insects*, we have seen no reference to a rational program of prevention of destructive pest development. Invariably the theme is that of killing the pests.

Scores of scientists participated in the correlated activities of insecticide production, entomology, and other fields of effort. Could these men be given a vision of how to collaborate with, instead of fighting against, the mightiest power in the universe; a vision of practical results achieved by "the correct blend of physical matetial substance," in which the life principle can manifest itself, then, assuredly, the Millenium would be nearer.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

Constellations — Great and Small

By ISABEL M. LEWIS

The constellations of today are eighty-eight in number, and they completely cover the entire celestial sphere, from north to south polar regions. Forty-eight of them are sometimes referred to as the "original" constellations. They are the ones known to the Greeks and the Romans of twenty centuries ago. In some of them they saw their heroes and gods of mythology transported to the heavens. Some of the more famous of these groups, such as Orion, Ursa Major, and The Pleiades in Taurus, originated, it is believed, many thousands of years earlier among the people who lived in the land between the Tigris and Euphrates, one of the cradles of civilization. From there, in story and legend, they were passed on to the Greeks. Hesiod wrote of them around 800 B.C., and they appeared in the epics of Homer and are known to be of great antiquity.

There were large uncharted regions in the ancient heavens. Most of these were below the horizon of the Greeks and Romans, in the region around the south pole of the heavens. Explorers of later centuries wrote with religious fervor of the Southern Cross, Crux, which they saw as implanted in the heavens to lead them on in a mission to establish the Christian religion among the savage tribes of Central and South America. They saw pass overhead, as they navigated the stormy Straits of Magellan, those large patches, which appear like detached portions of the Milky Way — "The Magellanic Clouds." The Large Cloud lies in the constellation named later Dorado, The Sword-fish, and the Small Cloud in another of the newer constellations bearing the name of Tucana, The Toucan. These Clouds were, of course, named for the explorer Magellan who sailed through the straits, which geographers

were later to give his name, in the year 1520.

Forty constellations in all were added gradually to the original constellations as astronomers engaged in cataloging stars, and making more modern maps of the heavens, filled in the regions which had been up to their times unnamed. Most of the early maps of the heavens showed the forms of the men, animals and inanimate objects for which the various constellations had been named; but later maps, and most modern ones, show, connected by lines, only the stars that were used to give the characteristic outline of a constellation.

In the entire portion of the heavens that comes into view in the mid-latitudes of the northern hemisphere there are about 70 of the total of 88 constellations that are visible, wholly or in part, in the course of a year. No star of the southern hemisphere can appear above the horizon of an observer in a northern latitude if that star's declination south of the equator is greater than 90 degrees minus the latitude of the observer north of the equator. The brilliant Canopus, for example, has a south declination of about 53 degrees. The latitude of an observer in New York is about 41 degrees, so he cannot see above his southern horizon at any time a star that has a declination south of the equator greater than about 49 degrees. This would mean that Canopus, with its south declination of about 53 degrees, cannot appear above the horizon in the latitude of New York. This neglects the effect of refraction, which may bring into view an object that is a degree or so below the horizon. This would not be sufficient, however, to bring Canopus above the horizon for an observer in the latitude of New York. This beautiful star can be seen briefly in the United States at certain seasons and times of night, however, by observers south of about 37 degrees north latitude.

Man gave free rein to his imagination when he saw and gave form in the heavens to his heroes and gods, beasts, birds, and fishes, and such a heterogeneous assemblage of objects as triangles, sextants, tables, crosses, dippers and crowns. With the exception of the triangles, and the dippers, the crosses and a few other of these configurations, there are few constellations that bear the remotest resemblance to the objects for which they have been named. The Sickle, in the constellation of Leo, is a configuration of stars that does resemble a sickle in form; but it would take quite a stretch of imagination to see it as the head and mane of the lion, Leo. It would take considerable imagination, also, to see Denebola, the second magnitude star, as marking the tip of the tail of Leo, or the first magnitude star, Regulus, as marking the heart of Leo, as one of the older names for this star, Cor Leonis, would indicate.

It would not be so difficult to picture Orion as a huge, towering, giant-like form brandishing a club over his head; or even to visualize the head of Taurus with the V-shaped group of the Hyades marking the forehead; and Aldebaran as the fiery red eye of The Bull, charging with lowered head toward Orion — the tips of the horns marked by two bright stars, one of them the southermost bright star in Auriga.

Flighty Hunter

By RAY ROMINE

The dipper handle this month is our guide:
We round its curve to reach Arcturus' glare,
The light by which Bootes' mighty stride
Tries futilely to catch a Polar bear.

The curve continues on to Spica, where
The jewelled Virgin sits, serene and sage.
Her diamonds sparkle while she probes this flair
For antics in a man Bootes' age!

Ursa Major is a magnificent constellation, especially in high northern latitudes. Its form is quite easily traced, at least the part of it known more popularly as The Big Dipper. To picture the long handle of the Dipper, though, as the tail of Ursa Major, the Greater Bear, really requires some explaining. This, I believe, is forthcoming in the story that since the bear is being swung around the pole continuously by his tail it has become considerably stretched. It is not so difficult to follow the stars known as "The Pointers" in the bowl of the Big Dipper, the two stars farthest from the handle, to the second magnitude star, Polaris, the North Star. Its distance from The Pointers is about equal to that of the entire length of the dipper itself. One may picture the entire form of this huge constellation with the aid of the curved line of third and fourth magnitude stars, preceding the bowl of the dipper, which represents the back of Ursa Major. They outline the head and forelegs of the bear, and the group of stars directly below the bowl of the dipper represents the hindlegs. It is in its complete form an enormous constellation. The mistake is sometimes made of considering the Big Dipper, which is actually only a *part* of Ursa Major, as a constellation in itself. It is one of the most interesting and probably most easily recognized configurations of stars in the heavens, with the possible exception of the Southern Cross, Crux, in the southern hemisphere; but it is not a constellation in the accepted meaning of the term, as also The Pleiades, in Taurus, are not in themselves a constellation, but a part of the constellation of Taurus.

In the constellation of Ursa Minor, The Lesser Bear, the North Star, Polaris, is located at the end of the handle of a Little Dipper. Like the Big Dipper it is formed of seven stars, but, unlike the brilliant stars of the Big Dipper, they are faint, with the exception of Polaris which is a second magnitude star as is also one star in the bowl. One should have no difficulty in tracing the outline of the Little Dipper in this farthest north constellation of Ursa Minor. These two constellations, Ursa Major and Ursa Minor are always visible in the night skies at all times of year in the mid-latitude of the northern hemisphere. For the beginner who wishes to learn the principal constellations visible in northern latitudes in season (Continued on page 220)

LOST EDEN

(Continued from page 208)

snowshoes I found that deer, bobcat, marten, mink, rabbit, wolverine, fisher, porcupine, weasel, mouse or shrew had been coming to call, but appeared to have changed their minds. Only the goats and marmots remained aloof on the summits, and the bears, grizzly and brown, did not put in an appearance until the first berries were ripe. I did not miss the bears so much, but I did the golden-mantled squirrels and the chipmunks, which had scolded me, chased each other, and would probably dig up my bulbs again come spring.

So it went through the years. Season followed season and I could never decide which one I liked the best. The cabin gained a bedroom, kitchen, another porch and two more doors. The outer walls were covered with hemlock bark. Flower beds and rockeries were all around it and beyond them stretched big vegetable beds, for I sold much of my produce to summer fishermen and prospectors. Everywhere were the wild berry bushes, and, built into a side hill, a roothouse to hold their bottled fruit. There was a ram to pump river water and a tank to hold it. There were irrigation trenches, and wood piles covered with bark stood at the forest's edge. The house was painted inside and out, but even so it still had a wild air and nothing was too neat, too orderly. Nature is not that way, so why should I, who had built her bounty, be any different?

That was how it was in the May that almost closed my seven years in the Selkirks. It had been a late spring followed by ten days of unseasonably hot weather, which had sent melted snow from the mountains rushing down my river. Each night I listened to wilder symphonies than I had ever heard before, and each morning I expected to see the cage platforms gone and to know that I was more than ever cut off from the world. As far as food was concerned I could have existed for years without buying any outside, so that did not worry me. But one night I wakened just before dawn, strangely disturbed, and thought: "The river sounds like a coronach on bagpipes." I could not go to sleep again.

That morning I did my last spring work on the flower beds and put the last touch of paint on house and outbuildings. I worked even harder than usual and hardly paused for lunch. Somehow I wanted to get everything finished that day, although I could think of no good reason why I should. But before five it was all completed. When I walked around on a final tour of inspection I realized that this was the first time in seven years that there had not been a job of physical work clamoring to be done. Now my Eden was just as I had visualized it, even to the teal-blue doors and windows of the cabin. The woodshed was filled, heater wood piled high outside, the roothouse whitewashed so as to show off the many full jars better, and in the workshop each tool had its place. I got my camera out and began taking pictures from both sides of the river.

But instead of feeling satisfied I was restless, and when a neighbor shouted from across the Rinn I was glad to go over and collect the boxes of food and oddments, which he had so kindly packed in for me. He was going farther along and could not stay for supper. I started to get my own, unwrapping parcels and putting things away in between times. At dusk when I went into the bedroom to get ready for bed, I thought that the house was hotter than I had ever known it at this time of year.

It was just as I got into pajamas and dressing-gown that I heard the explosion, like a big gun going off right over my head. What in the world? As I stood there wondering I heard a crackling noise as though there was a fire in the heater. But there was not. Rushing out into the living-room I saw flames licking through the ceiling just over my desk and one look was enough to tell me that the cabin was doomed. Later I was to discover that the bang had been a spontaneous dust explosion in the attic, which had been built without louvers; the same sort of thing that happens sometimes with hay in a barn when there has been a long spell of wet weather followed by intense heat.

I grabbed for manuscripts, filing cards, typewriter — everything I could carry that had to do with my work as a writer. When my arms were full I dashed outside and flung the things down on the ground away from the cabin. Then I rushed inside again and began pulling precious books from the shelves. I saved only seven of the most valuable — which happened to be also the largest — out of more than 200 that I had collected for reference over many years and most of which could never be replaced. But the ceiling was blazing and there was so little time — so little time. As I stood by one of the bookcases I looked up and saw yellow daffodils standing on a window-sill in a blue-green vase. Wildly I thought: "I must take that window with me!" Strange what wild ideas come to one at such moments.

On my third trip I threw open the cupboard doors and grabbed up shoes, clothes, more books — anything I could lay my hands on. As I ran across the living-room with them sparks fell in showers from the burning ceiling and clothes, dressing-gown and even my hair began to smoulder. When I threw down my load and turned to go back a fourth time, the ceiling fell in with a crash and the little cabin became an inferno of flames. By the watch it had been just seven minutes since the fire started. So short a time in which to lose almost all I had in the world.

Stumps began to blaze here and there in the clearing from the great heat of the blazing cedar walls. A curl of smoke

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The School Page

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

SAND-DUNES, SEA-BEACHES, PINE BARRENS AND WASTE LANDS

TO MORE THAN 500 naturalists one or more of the types of localities listed above have a particular significance. To a few of us all four locales represent highlights in a group of four winter field trips. These are all places I have visited in connection with the Christmas field trips of the American Nature Study Society and the National Association of Biology Teachers. My first trip of this series was in bitter cold and violent winds to the sand-dunes near Chicago. The second was an experience with the snowy owls and dovekies at Jones Beach on Long Island. The next was in a windy rain storm to the pine barrens near Philadelphia. As I write I have just returned from a visit to the Busch Wildlife Area near St. Louis. Next winter we meet in Boston, and in 1954 in San Francisco. This is a report and an invitation regarding these trips, which I hope one day you can enjoy really and not vicariously.

I have never been on one of these trips without coming away with an idea that I am sure will remain with me the rest of my life. I cannot here review the earlier trips, but will report on the latest one. I rather think it exceeded the highlight of the snowy owl sailing out over the crowd at Jones Beach, and off over the blue sea in the background in a brilliant sun.

The St. Louis field trip was held on December 27. The leadership included Dr. Roger Tory Peterson, president of the American Nature Study Society; Dr. Harvey Stork, president of the National Association of Biology Teachers, and a half-dozen others, including yours truly. As should be the case at least two philosophies were represented in the trip leadership, and both yielded results. One philosophy called for high-tailing it over the countryside to cover as much ground as possible in the allowed time. The other called for the technique of sitting down to see what could be found here and there. Neither was carried to the extreme. The hightailers did stop for a few minutes, and the low-tailers did move a few bus-lengths away from where they alit. I shall report on the experiences of the lowtailers.

We made five stops on the St. Louis trip. In each case, I moved out to the edge of the assembled crowd, and, while general directions were being given, discovered almost at my feet enough to have kept us busy for the whole day. On the first stop I stepped to the *edge* of some winter wheat and windblown sand. I felt that if there would be anything interesting it would be at the *edge*, and there it was. The wheat showed beautifully the anchoring properties of plants, and the tracks of a cat right along the edge showed how the master hunter of wildlife knew that supper lay where food and cover were close together. A little later we found raccoon tracks and crow tracks, and in each case they were near edges.

The second stop was at the edge of a marshy area. While the hightailers went gallivanting off over the hills and far away, we discovered the effect of frozen ground on life in a vertical foot. I think we got as much as they did without getting as much mud in the bus afterwards.

I wish I could elaborate on the excellent meal served us at the Wildlife Area headquarters, and on the rabbit tracks and microclimates of that headquarters area, but I cannot. It was gratifying to see the concern the permanent leaders at headquarters had over two red-tailed hawks that had been accidentally killed by flying into obstructions. One does not always get such sense in such places.

At the fourth stop I again moved out at the edge of the crowd to see where I would like to work. There on a sign I spotted a phoebe, which seemed out of season to a New Yorker. Almost immediately it was spotted by an ornithologist, who announced that it was a Say's phoebe, to which announcement Roger Peterson objected vociferously. Then, on examination, he found that it *was* a Say's phoebe, which was probably the first record of that western species for the St. Louis area. After that anything further at that stop was bound to seem insipid, even though it was not.

The fifth and last stop for me was possibly the most fun of all. The hightailers had a hunch that one could find those black-headed Harris sparrows there. I had not seen a Harris sparrow in years, although it was one of my favorites when I lived in the middle West. Still I had told myself, and a few others, that on that stop I would not go more than two or three bus-lengths from where we stopped. I am glad I made the boast because it paid off. At the fourth stop we had caught a meadow mouse and en route had been studying the animal. When we got out of the bus again I said that it might not be a bad idea to find a meadow mouse nest, since none of my immediate group had ever found one on their own.

Again the group had a general meeting before the hightailers vanished. Again I moved to the outskirts and waited. When the nomads had moved on I looked over the field and noticed that one small patch of grass, about a foot long and almost as wide, had the grass growing probably three or four inches higher than any of the other grass to be seen. I figured that there must be a reason for this difference and so sat on the ground and began to investigate. As I expected, the grass tuft was riddled with mouse tunnels, but soon I discovered a bone. It was nicely cleaned and so I looked further. Sure enough there was another bone. Eventually we uncovered a whole skeleton. The upper jaw had four teeth in front, instead of the two we had seen in the meadow mouse, so it probably was a lagomorph, and the most likely creature of course was a rabbit. Then the question came up as to why the grass was higher, and, of course, the answer lay in the enrichment of the soil by the rabbit carcass. And the richer soil gave more grass which attracted more mice that riddled the spot with runways and so the story ran.

When we got through one field-tripper remarked: "How in the world did you find that rabbit skeleton in that whole field?" The answer was simply that there was something different, and that difference needed an explanation. That, ladies and gentlemen, and boys and girls, is where the fun lies in these winter field trips of the American Nature Study Society and the National Association of Biology Teachers. I hope that I may see you with the low-tailers at the Boston meeting in December, and at the San Francisco meeting in 1954.

While we outdoor folk were learning things first-hand, those who wrote the book that stimulated my last month's eight-page insert in this magazine were sticking close to the hotels politicking to their hearts' content. Just before I left home for the St. Louis meeting I received a mimeographed sheet, which I have beside me. It was not signed but from the post mark I assume it was from one of the "master minds." The sheet said: "I shall probably present attached resolution to the meeting at St. Louis and if you approve I hope that at least one member of Section Q Committee will be there to second it." The Resolution, which was to have been presented by "Section Q to the Council of the AAAS at St. Louis" reads as follows: "It is considered inappropriate to publish in the journals of the AAAS any articles which attack the honesty, integrity, scholarship or sincerity of motive or which are otherwise abusive of the members as a group of any of its sections or affiliated societies." It might have been signed Uncle Joe, but it was signed by no one. I had an opportunity to talk the matter over with a past president of the AAAS before the Council met, and we both agreed that such a philosophy would get nowhere. How can one praise scholarship that may

not exist? Mayflies do not eat mosquitoes as immature or mature animals, even though high officials in the field of science teaching say that they do in their books. Monarch butterflies are not yellow and brown. The xylem of dicots is not necessarily woody. The scientific name for all birds is not Aves, and so on down a long list. It may be understandable that those responsible for this sort of scholarship should ask that their works be excluded from criticism, but it is not in the spirit of science, as I know it, or as I have seen it demonstrated in these field trips I discussed earlier. We argued about the Say's phoebe but it was a Say's phoebe, no matter what we said. You may get your way by pulling political strings in some fields, but you cannot argue with the evidence supplied by the dentition of a rabbit, the feathers of a Say's phoebe, or the story left by the cat that demonstrated the theory of edges. Up which path do we go to experience true education?

LOST EDEN

(Continued from page 215)

went up from some of the papers I had dropped too near the cabin and when I went to rescue them and my typewriter I had to crawl along the ground shielding my face with one arm. I scorched my fingers on the handle of the metal typewriter case as I pulled it to safety.

There was hardly any wind, but I realized that if the woodshed and particularly the forest were to be saved that I must do it. Outside the kitchen door, where the wall had not begun to burn, I found two buckets and filled them at the river. Then began my night-long work of salvation. Beyond the range of that unholy light of fire there was only darkness and solitude. I did not hear the little wind in the evergreens, the noises of the river; there was nothing left in the world for me except buckets to be filled and emptied and filled again. I stamped out sparks, I beat out small blazes with my hands, I took off my dressing-gown and used it to smother a leaping rush of flame. At one period I remember thinking: "My heart won't take much more of this. It will have to be the forest or me." But of course I chose the forest — and when dawn came I was still alive, too.

I stood on what remained of my lawn and looked about me. The flames had died down, but the great mass of ashes, which had been my home, was still too hot to handle. Glass and metal had fused together, tins had exploded and now lay in blackened heaps. The great sill beams were charred and shrunk to half their size. Here and there a tool, with all its temper gone, thrust up from the ruins. But the woodshed and roothouse were untouched and only those flowers had died that were in the beds immediately around the house.

Everywhere else daffodils blew golden in the wind, echoed by the wild yellow violet. Hyacinth, crocus, Lenten rose, grape hyacinth, bluebell, lily-of-the-valley, pansy, quaint English daisy, tulip bud and wild pink currant filled my valley with color and beauty. Beyond them lay the vegetable plots with their long green rows and beyond that the singing river. Little rosy clouds floated across a deep blue sky above green mountains, as they had done in so many spring dawns. But except for the Rinn's voice there was a hush more tangible than any I had ever known, even at the hushed break of day.

Suddenly it was broken by a silver lilt of notes from a thimbleberry bush only a few yards away from me. Again and again came that rush of trills, the song sparrow's lovely song. As I listened to it something that had been very heavy and silent on my heart seemed to lighten and dissolve. I threw myself down on what remained of the green grass and I am not ashamed to say that I lay there and cried for all the beautiful years that were only ashes now.

Not only the years, but the work that had gone into them. Many manuscripts had burned, including a 125,000-word book on wildflowers of the Selkirks, which I had illustrated with my own photographs. Nearly 100,000 words of another book and only a little less than that of a third had gone, together with many files, negatives and all my flower collection. My library too, of course, and all the many other things that I had gathered round me so slowly and so happily.

But if my little cabin had to die I was glad it could go when it was most beautiful; painted and polished and shining with my heart's love; even the last weed pulled from the garden and the last bit of furniture made. I was glad, too, that there was a song sparrow to sing its requiem over the pyre at dawn — and that in my mind's sight nothing could change now. Firelight would still shine on my rows of books, the cedar-panelled walls would gleam like satin, the deep red rugs glow on the dark floors with the Dutch blue furniture standing on them invitingly. The green roof would always speak softly to the tile-red porches, the teal-blue window-boxes spill over with flowers and the teal-blue doors stand wide open to life and beauty.

But late that afternoon — after I had thrown the blown and blackened cans into the river, laid the charred beams neatly and raked earth over ashes — I crossed the Rinn on the way to my neighbors. When I reached the other side I looked back from the platform, where I had stood so often looking down at bark walls, shake roof and smoking chimney. Now, if I had been a stranger, I would never have known that any home had stood there at all, for I could not see the woodshed and roothouse. Everywhere else there was only greenness blowing in the spring wind, with spring flowers starring it. It was at that moment I thought my heart would really break.

Camera Trails

By

EDNA HOFFMAN EVANS

"THE flowers that bloom in the spring, Tra la," make nice camera subjects, in case you have never noticed. However, I suspect that every Nature camera fan has at one time or another noted the photographic possibilities of flowers.

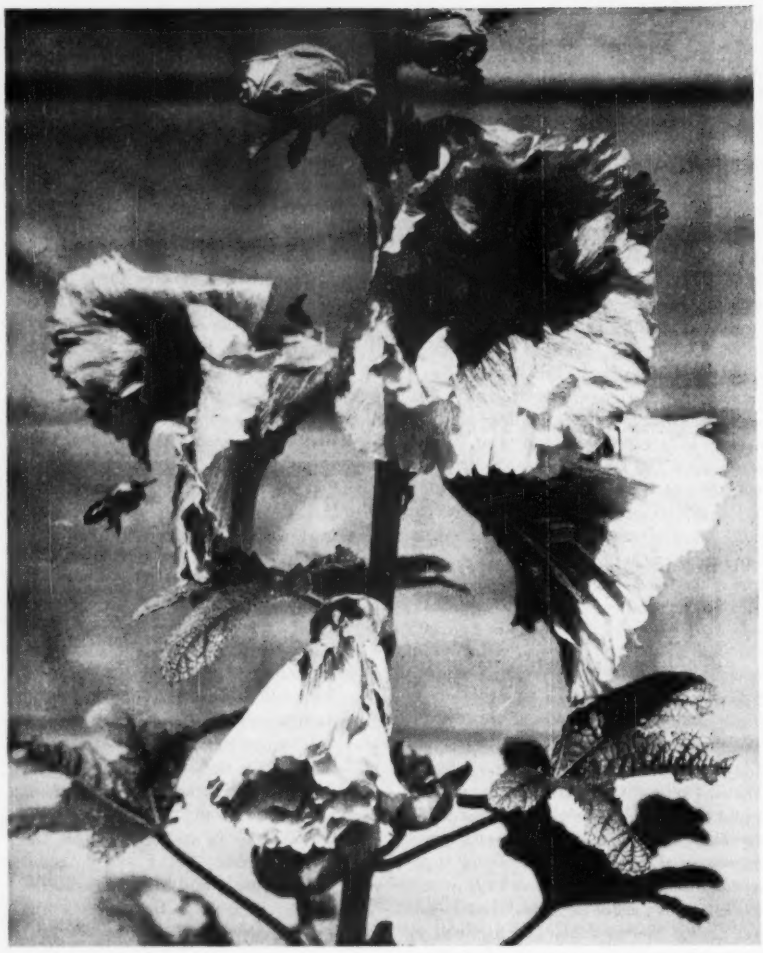
Regardless of whether they are shy spring beauties nestled in a bed of new grass and last year's old brown leaves, or a highly cultivated greenhouse aristocrat with a formidable pedigree, flowers are appealing photographic models.

Flowers and color, of course, are closely allied. So, too, are flowers and color photography. When one is accustomed to color transparencies, black-and-white renditions of flowers seem rather dull and uninteresting. Looking through my file of negatives in preparation for this section, I was quite surprised to find how few black-and-white shots I have made of flowers in recent years. That certainly is not true in the slide file. Yet there are limitations to what one can do with color slides. In considering the techniques of color photography, many of the same principles apply to pictures taken with either black-and-white or color. Composition, lighting, background, and the like are important, regardless of the kind of film we are using.

Now that April is here and winter should be on the wane, if not entirely departed, let us take our cameras and go outdoors in search of suitable subjects. We will find different flowers, depending on the section of the country in which we live. Light conditions, too, will be different, but we can allow for that when we make our exposures.

First, we must consider the time of day, for that largely determines the angle of our light. In the morning or late afternoon, when the sun is nearer to the horizon, the rays fall on our subjects at a low angle, producing side light. When the sun is overhead at noon it gives us a top light.

A top-lighted flower picture is not a particularly good one for the shadows are cast downward, making the picture harsh and flat. Side light is usually best for flowers, especially side light in the morning, for most flowers are at their pristine best at that time of day. Late afternoon sunshine gives the same light angle but often by this time the flower has passed its prime. You may not have to get up before the dew is off the petal, but you will find that your best flower picture chances come fairly early in the day.



This hollyhock picture shows how the angle of light can bring out or obscure details of texture. The bee on the left arrived in time to be photographed, but the shutter speed was not fast enough completely to stop wing action. Bees' wings move much too fast for ordinary photography.

Bright lighting is best for single flowers or for arrangements (either natural or artificial) containing only a few individuals. Landscape-type pictures, shots showing massed flower borders or garden settings, are best taken on duller days. In cases like this the brighter the sun's rays, the less detail one can obtain in the picture. But on cloudy days the delicate texture of leaf, stem, and petal can be emphasized. Even on cloudy days one should pay attention to the light direction. Do not shoot toward the light source on a cloudy day any more than you would on a sunny day. Light from over the shoulder of the camera operator usually brings out the best in the subject.

So much for light and light direction. How about the poses of our floral models? This is just as important as the posing of any other kind of model.

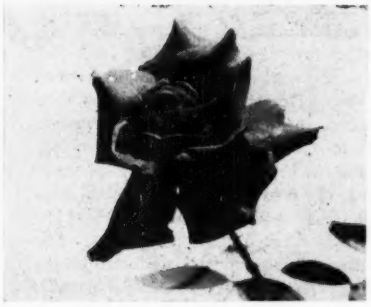
There are several simple rules to be kept in mind in taking flower pictures. First, do not use too many flowers — that is, of course, unless you are taking a mass picture. Usually you will find that odd numbers of flowers — one, three, or perhaps five — will give you a better arrangement than an even number.

Second, in posing your flowers, avoid crossing stems. A stem shooting off in one direction, crossing over a second shooting off in another is definitely distracting. On the other hand, avoid perfect parallels, as well. They make for as much monotony as the crossed stems did for confusion.

Third, avoid straight, vertical lines. Your stems may grow up straight and tall, but they make better pictures when they are shown at a slight angle.

Finally, do not try to make your arrangement geometrically symmetrical. Strive for balance rather than for repetition of line, form, or design.

Of course, while flowers do arrange themselves beautifully and gracefully in Nature, the resulting photograph may not be all that you hoped it would be. The flowers may be too far apart, either from left or right, or from front to back, to make a good picture. Faded flowers, unnecessary leaves, photographically unwanted buds may spoil the composition. You, the photographer, can remedy this in various ways. You can trim away extra flowers and foilage (assuming that you are able to cut and prune at will). Or you can tie unwanted branches and stems



A dark red rose silhouetted against a light background gives a striking effect.

out of the way with string, or hold them back with spring clothespins or some other sort of clips. You may also pull desirable flowers closer together in the same manner.

If you want to cut your models and move them to a more workable location, better still. But remember that cut flowers fade quickly. Work fast for your model is a highly perishable one. In photographing a very special blossom, some cameramen use be-petaled "stand-ins" — lesser flowers put in place to determine the focus, arrangement, and exposure. Then the "star" is substituted for the final picture.

One good way to pose flowers you have cut is to thrust their stems into a vase or container filled with mud. The moisture therein serves to keep the flowers fresh, while the mud gives secure anchorage, but not absolute rigidity, to the stems.

Another important factor in flower photography is the background. This can be so confused and distracting that the entire force of the picture is lost. Indeed, the flower can blend so well into its background that it ceases to be an individual at all.

Sometimes it is possible to throw the background out of focus so that it does not detract from the center of interest. This device is not always possible or successful. Another technique is to lower the camera and shoot up at an angle so that the flower is silhouetted against the sky. This, also, is not always possible. Or, when it is, the angle is so great that the flower is awkwardly posed or distorted.

Often the photographer can use a piece of cloth — dark for light flowers and light for dark ones — as background. This can be arranged behind the flower so as to cover the distracting background material. Care should be taken, however, to make sure that other portions of the blooming plant's anatomy — stem, leaves, and buds are not obscured by the tone value of the cloth background.

Now one final point regarding the posing of the flower itself. Should it be shown in profile, three-quarter, or full front view? Here again the answer depends on several factors. The flower itself may determine the answer. Rarely will you want a full front view (unless you are striving for seed-catalog accuracy). A flower's petal arrangement, be the flower a rose or a camellia, a lily or a violet, is usually too symmetrical, too geometric, for good picture composition. Avoid shots like this unless symmetry is what you are striving for.

Instead, show your flower at something of an angle, with more petals showing on one side than on the other. If the flower is a deep one, that is if there is a long distance from the tips of the petals to the heart of the flower, it is best to show a side or semi-profile view. Otherwise, owing to the depth of field to be covered, one portion of it is bound to be fuzzy and out of focus.

All this, of course, can be applied either to black-and-white or color photography. There are some differences of technique, owing, chiefly, to the difference in film speed and the way in which the colors are recorded on the films themselves. In a color picture there will be great contrast shown between reds and greens. In black-and-white, on the other hand,

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reds and greens of the same intensity will blend so as to be completely indistinguishable.

As for filters, use them with care, if you use them at all. They help, certainly, in emphasizing some color values in black-and-white photography. However, I think each photographer has to experiment for himself with filters — and he should not be too surprised or disappointed if the results are not exactly what he expected. I tend to make less and less use of my filters as time marches on. They go along with my other equipment, of course, but rarely do they add anything but extra weight.

But filters or no filters, regardless of where you do your hunting, and no matter whether you find cactus plants blooming

(Continued on page 220)

THE CHLOROPHYLL CRAZE

(Continued from page 184)

If they use the water-soluble chlorophyllins used in other products, one washing would remove all of the chlorophyllin. Even the chlorophyll derivatives, which are not water soluble, would not survive much laundering. One suspects that the chlorophyll will be nothing more than some green dye. As a matter of fact, it seems quite likely that many other products actually contain little or no chlorophyll, and that the green color is mostly due to some dye. Products with a particularly bright green color are especially likely to contain a green dye, since none of the chlorophyll derivatives has this bright green color. When several well-known chlorophyll tooth pastes were tested for their content in the laboratories of one of our leading universities not a trace of the substance was found. While such use of green dyes in products claiming to contain chlorophyll is of course fraudulent, it is probably not a matter for serious concern since the chlorophyll itself seems to be so ineffective as a deodorant.

It looks as though the great chlorophyll splurge is just the latest and biggest of a long series of schemes promoted to fool us and part us from our money. Pitchmen and testimonials alone used to be able to turn the trick and sell us gallons of highly recommended but worthless patent medicines. Now such schemes must also have a scientific slant. Counting on our faith in the miracles of modern science, and our limited knowledge of scientific facts, our modern pitchmen and hucksters blow a small amount of distorted scientific fact and theory into an immense froth of fantastic and unfounded claims. We may have to wait for the results of more extensive scientific tests of chlorophyll products before we can tell just how much actual fact is present in the chlorophyll froth, but the way it looks now it is amazingly little. If you like things green go ahead and buy chlorophyll products, but if you want to be deodorized pin your faith on something else.

CONSIDER THE MINNOW

(Continued from page 188)

space and feed upon the same foods eaten by the young of all the important game and food fishes. Few are large enough to be suitable for human consumption. The few exceptions are carp, goldfish, fallfish, and squawfish. The latter is a Pacific Coast region minnow that reaches a weight of 80 pounds. Carp, goldfish, and squawfish often increase in such numbers in rivers and lakes to a point where they are regarded as pests. Few of the small, finger-sized minnows ever assume epidemic proportions. In recent years their numbers apparently have been depleted in some rivers and lakes; in Maryland a special law was passed limiting the number of bait minnows that could be seined to 35.

Minnows are one of the essential links in the chain of aquatic life. The productivity of lakes and streams, and the importance and success of a sports fishery, is predicated on the abundance of minnows. If anything, the minnow should cease to be taken for granted.

IT'S A LITTLE DOG'S LIFE

(Continued from page 191)

A quarter century ago, Grant County, New Mexico, had a third of its area covered by dog towns, with an estimated population of 6,400,000. Northern Arizona was one continuous dog town; it was difficult to be out of sight and hearing of these barking squirrels. Western Texas and other States contained areas as thickly populated as northern Arizona. Then drought years accented the conflict for forage between livestock and the dogs, and mass war hit the wish-ton-wish towns.

Poisoning and epidemic have done their grisly work. To find a prairie dog town today, watch the cheery, scampering play, the industry of the community, the manning of the watch-tower mounds, one must search wide stretches of country. Like the bison, which has found last-stand refuge in national parks, the prairie dog may have sanctuary there. But in other areas he faces liquidation.

If you watch along the highways as you drive toward the Rockies, looking for a prairie dog town where the sentinels cry out the news that you are entering the historic West, you will not have the barking squirrels to welcome you. Already they have all but vanished into history's realm and the storied West of the yesterdays.

CONSTELLATIONS — GREAT AND SMALL

(Continued from page 214)

throughout the year they are excellent guides in locating and identifying other constellations.

The constellations differ greatly among themselves in size. So large was the constellation of Argo Navis, The Ship of The Argonauts, that it was broken down into its various parts, Carina, The Keel; Vela, The Sails; Puppis, The Stern; Pyxis, The Mariner's Compass. Largest of all the constellations is Hydra, The Sea Serpent, which is now visible in the evening skies in April with its riders Corvus, The Crow, and Crater, The Cup. The head of this enormous creature lies directly below Cancer and it extends eastward below Leo and Virgo to a point below the southeastern horizon at this time, where the end of the tail lies south of Libra. Other great constellations include the long, winding constellation of the river Eridanus, starting near Rigel and ending far below the southern horizon, the constellations of Virgo, Hercules, and Ophiuchus with Serpens, in summer skies, and Pegasus with its Great Square visible in the fall. Centaurus in the southern hemisphere is one of the largest and most brilliant constellations. Among the best known of the smallest constellations are Crux, The Southern Cross, in the southern hemisphere; Lyra, The Lyre, with its magnificent Vega; Corona Borealis, with its second magnitude gem, Alphecca, and the interesting group known as Delphinus, The Dolphin, or more popularly as Job's Coffin, to the southeast of the Northern Cross.

April is the month in which one may see around the 21st, for several nights, members of the swarm of meteors known as The Lyrids. One should look for them after midnight as they come from the general direction of Lyra in which their radiant lies. They are swiftly darting and brilliant and average about ten an hour.

Venus will be at inferior conjunction with the sun on April 13, when it will pass to the morning sky. It will be too close to the sun for observation most of this month. Mercury will be at greatest western elongation in the morning sky on April 15. It will be almost too low in the east at sunrise for easy identification. Mars is now low in the west at sunset and passes from Aries into Taurus this month. Jupiter also may be seen low in the west this month for a short period after sunset. It passes from Aries into Taurus this month and may be seen southwest of The Pleiades. It will be in conjunction with Mars on April 27. Saturn will be in opposition to the sun on April 14. It will rise in Virgo, east of Spica, about sunset and will be visible through the night.

CAMERA TRAILS

(Continued from page 219)

in the desert or shy trilliums in the woods, violets in the meadow, jack-in-the-pulpits, dutchmen's breeches, Indian paint brush, lupine, or strange semi-tropical blossoms, spring is here and the flowers are a-bloom. It is a fine time for flower pictures.

ODDS AND ENDS manage to accumulate much faster than I have time to study them and space to make use of them. The following is one that has been waiting:

For the home movie maker who wants to add some trick effects to his films, Bell and Howell Company, 7100 McCormick Road, Chicago 45, Illinois, has published a little pamphlet called "Tips on Movie-Making Tricks." If you want to film ghosts, or reverse motion, time-lapse sequences, or other out of the ordinary shots, send a nickel for the pamphlet or see whether you can obtain one from your local photo shop.

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UNDER THE MICROSCOPE

By JULIAN D. CORRINGTON

ADAPTATION

"The bee is an artisan of many trades and is provided with tools sufficient for all its needs. Some of its most important tools are parts of its legs."
— Snodgrass

ONE of the most obvious facts about living things is that they are adapted to their environment. Indeed, the fitness of the plant or animal for its surroundings is so universal, so ubiquitous, and so apparent, that *adaptation*, as a biological principle, is taken for granted and is seldom if ever taught as a separate topic.

Suitable material for exemplifying adaptation is everywhere about us, but there is no more striking, inexhaustible, or convenient field than that of insect external anatomy. A whole array of specimens may be contained upon a few microscope slides, and an almost infinite variety displayed by undertaking studies of insect antennae, mouthparts, wings, or legs. In each case the adaptations of these parts will be found highly interesting and instructive. We have selected legs this month, as the correlation between structure and use is more readily seen in locomotor organs than in others.

There are generalized, all-purpose insect legs, and highly specialized, single-purpose legs. There are legs adapted for walking, running, leaping, digging, climbing, or swimming, and we shall have more to say about some of them later. Those of the honeybee, however, are even more fascinating to study since, in addition to their primary function of walking, they each have special added features concerned with non-locomotor duties.

One of the names for the Class to which insects belong is *Hexapoda* (six-feet), indicating a unique characteristic that separates insects from crustaceans, spiders, and other allied animals. All insects have six legs. A better way to put it is that they have three pairs, and these are designated according to the segment of the thorax from which each arises. In this manner they are termed the prothoracic, mesothoracic, and metathoracic legs, from front to rear.

A typical insect leg has five parts: from the body outward they are the coxa, trochanter, femur, tibia, and tarsus. The first four of these are separate and single segments, but the tarsus is subdivided into (usually) four or five segments. In bees, the first division of the tarsus is much larger than the others and is signalized by a name of its own, the metatarsus, called also the basitarsus or planta.

Prothoracic leg, worker honeybee.

It should be noted that these parts are commonly referred to as "joints" of the leg, whereas the true joint, as in human anatomy, is the articulation between two segments.

Two terms of great utility in referring to parts of appendages are proximal and distal. *Proximal* indicates nearness to source; a location nearer the center of the body than that of some other structure. Thus, the coxa is the proximal segment of the leg; the metatarsus is the proximal division of the tarsus. *Distal* indicates the opposite location, - distant. The tarsus is the distal division of the leg.

These names for the segments are borrowed from human anatomy and applied to unrelated insect structures

Mesothoracic leg.

whose position more or less simulates that of portions of the human leg. *Coxa* is Latin for the hip, a joint in man, a segment in the bee, where it is larger and longer than customary among insects. The *trochanter* or second portion of the insect leg is again, in bees, larger and longer than ordinary; in man the word designates one of two processes for muscle attachment at the upper end of the thigh bone. The *femur* or third division of the insect leg was named from the bone of the first segment in the leg of man, since it is generally the thickest and, as in the bee's first leg, sometimes the longest division. This is the part that is so large and stout, housing powerful muscles, in the grasshopper's third leg. Next comes the *tibia*, named from the larger of the two bones in the human shank. Commonly this is slender and the longest of insect leg segments. It is prominent in all bee legs, but especially long and stout in the third. After the tibia is the *tarsus*, meaning ankle in man but the foot in entomology, being that part on which the insect walks, and has five segments in bees. The *metatarsus*, the specialized first tarsal section, is more or less as large as other chief leg divisions in bees and, in the third leg, is the widest of all leg parts. In man, the metatarsus is the instep of the foot. The last tarsal segment bears a pair of notched *claws*, between which is a fleshy pad, the *pulvillus* (little cushion), whose cells produce a sticky secretion. Claws and pulvilli enable the bee to climb and cling.

All bee legs are clothed with hairs, the density, length, stiffness, and structure varying from place to place. Closely spaced, unbranched hairs, forming a tuft over a limited area comprise a *brush*; short, stiff hairs all pointing in one direction and occurring in one or more rows make up a *comb*; while long, soft, branched hairs, generally distributed over the body and on the unspecialized portions of the legs, serve to collect pollen.

The *prothoracic leg* is a bit smaller than the others. Along the front edge of the inner surface of the tibia occurs a fringe of short and stiff hairs, the *eyebrush*, with which the bee removes pollen and other foreign matter from the compound eyes. The metatarsus likewise has modified hairs, long and bristle-like all around, forming a cylindrical *pollen brush*, reminding one of a bottle brush. It is used to sweep up and remove pollen from all the fore parts of the body. One observer claims that this brush also is employed to clean the mouthparts. The most remarkable of fore-leg structures, however, is found between the tibia and metatarsus and is termed the *antenna cleaner*. A semicircular notch at the inner margin of the proximal end of the metatarsus is lined with a row of bristles comprising the *antenna comb*, and this is capped by a flattened spur, the *velum*, which arises from the distal end of the tibia. If an antenna is placed in the notch, it can be drawn between notch and velum and cleansed of pollen: the exact manipulation

Metathoracic leg, outer surface.

however, must be observed in the living bee, or preconceived ideas may be found incorrect. The velum is movable, but it cannot close over the notch by itself as it has no muscles of its own; the closure of velum over notch is effected by closure of leg joint, flexing the metatarsus on the tibia. Likewise, it is usually stated that the antenna is drawn through the cleaner, whereas the opposite motion plays the major role, - drawing the flexed leg along the antenna.

The *mesothoracic leg*, being in the middle, is the least modified of the three. There is a *pollen brush* on the flattened metatarsus, similar to that of the first leg, and used to remove pollen from the fore legs and adjacent body parts. Projecting from the distal end of the tibia, inner face, in a location like that of the velum of the first leg, is a *spur*, the most controversial of bee leg structures. It has been called the "pollen spur" and described as digging or prying the pollen balls loose from the baskets (soon to be discussed) when filling a cell of the comb in the hive; it has been said to support the wings while these are being cleaned by the nearby pollen brush of the metatarsus and, under the title "wax pick," it has been noted as removing the plates or scales of wax from the wax pockets on the under side of the abdomen, where this comb-making material is secreted. Possibly all of these observations are correct, and the spur is a multipurpose implement that performs all of these tasks.

Largest and most complex is the *metathoracic leg*. As in the others there is a *pollen brush*, on the outer face of the metatarsus, used in clearing pollen from the rear portions of the body and, as new structures, a pollen basket, pollen packer, and pollen comb. The *pollen basket* is most conspicuous and amazing when filled, and a deep-well or high-ringed slide may be prepared to show this condition. It is situated on the outer face of the tibia, which is not only concave, but also is bordered with incurving, stiffened hairs that assist in supporting the ball of wet and sticky pollen which is carried back to the hive, thus enabling the worker bee to spend more time in the field and make fewer and longer trips than would be the case without a specialized pollen-transporting device. Another term for the basket is *corbicula*, Latin for little basket.

At the distal end of the inner edge of the tibia lies the *pecten*, a comb of short spine-like hairs, opposite which, at the proximal end of the metatarsus, is a projecting, rounded, smooth lip or plate, the *auricle*. Pecten and auricle constitute the *pollen packer*; formerly they were termed the "wax pincer" or "wax shears," under the mistaken notion that they removed wax from the wax pockets. Lastly, on the inner surface of the metatarsus, lie some ten rows of stiff, distally-pointing spines, the *pollen comb*.

Those sufficiently interested in this topic as to wish to see for themselves, should first prepare the necessary mounts. Each leg may be placed on a separate

Metathoracic leg, inner surface

slide, but we have found a composite mount better, with one first, one second, and two third legs, the latter duplicated so as to provide both the inner view, for the pollen comb, and outer view for the pollen basket. These may all be arranged on a single slide. After removal from a worker bee they should be potashed in ten percent potassium hydroxide, washed, dehydrated, cleared, and mounted. The potashing requires a bit of experience: it should be enough to render the leg light brown in color, but not carried to the point of transparency. An important

step, before the cover glass is affixed, is to see that all of the legs are so flexed that the significant structures, as antenna cleaner and pollen packer, are not concealed.

When the slides have been prepared and studied — photographed, if you go in for photomicrography — the next procedure is to observe the use of all of these ingenious adaptations on live bees in the field. When a worker is visiting flowers and gathering nectar and pollen, she can be approached quite closely without danger to the observer's nose; don't be afraid of her, - she won't sting if unmolested. Should a reading glass or similar magnifier be available, take it along. Note that the bee becomes covered with pollen and see how this is brushed from the fore parts of the body by the pollen brushes of the first legs and mixed with other pollen that has been gathered by the mandibles and made sticky with regurgitated honey. Then this load is taken by the pollen brushes of the second legs, and finally by the pollen combs of the hind legs, the left comb receiving the contributions of the right side of the body, the right comb serving the left side.

Now the pecten of each metathoracic leg scrapes the pollen from the comb of the opposite leg, alternating, and a bit at a time. As increments are loosened, the tarsus is flexed and the pollen is packed by the auricle into the lower end of the pollen basket. Each addition adheres to the preceding mass, causing the ball of pollen to grow until very large and round Meanwhile the bee may also be employed in cleaning the eyes, antennae, and other parts. Back at the hive, the worker arches over a cell of the comb and uses the spurs to pry loose the pollen masses.

The drone and queen do not have the pollen-gathering and carrying structures. It is curious, therefore, that the size and shape of the greatly enlarged segments are approximately the same in these castes as in the worker; the tibia and metatarsus of the hind legs in all three castes are large, wide, and flat; but only the worker has the pecten, auricle, comb, and basket.

All of which points up the biologist's definition of a bee. To the poet the worker bee is the symbol of industry; to the student of government and sociology she is the perfect example of cooperation without friction; to the farmer bees are an important economic good, producing honey and wax of great value; but to the biologist the bee is, par excellence, "a bundle of adaptations."

REVIEWS

THE eighth edition of Chandler's *Introduction to Parasitology* is in reality a new book. Not only has fresh material been added in many sections, but the entire work has been rewritten, and the illustrations revised or replaced — about half are new. Yet the qualities that made earlier editions so successful have been retained; readability, enough taxonomy to place the many forms in proper perspective, emphasis on biological aspects, thorough coverage with special attention to the parasites of man. Much new information appears on parasites other than human, especially those of domestic animals, and the experiences of and since World War II have been incorporated. One reviewer of this book stresses its accuracy, another its thoroughness, another likes its recency and still another finds the humor to his fancy. It is indeed difficult to improve on Chandler's well-known volume as a text or reference for the subject. Pp. xii, 756; figs. 273. John Wiley & Sons, Inc., 440 4th Ave., New York 16, 1949. $6.00.

THE most beautiful text we have seen is the new sixth edition of Maximow and Bloom, *A Textbook of Histology*. This is an amazing volume of large size, the text printed in two columns, and the illustrations including a lavish use of color; they easily account for some 50% of the book's effectiveness, and this can be said without in any way detracting from the very thorough and carefully written manuscript. Under each heading there is usually a brief introduction on gross anatomy, to define and locate the tissue or organ, then the histology, with blood and nerve supply, regeneration, and histophysiological remarks, where functions are discussed with reference to normal observations, experimental work, and pathology. The stress throughout is on cells rather than tissues and on their activities, interrelations, development, metaplasia, and other functional aspects. Pp. x, 616; illustrations 986 on 580 figs., 257 in color. W. B. Saunders Co., West Washington Square, Philadelphia 5,1952. $10.00.

OPTICAL TRICKS
The Floating Finger

DO YOU believe everything you see? We hope so, for it is much more fun to pull tricks on someone who is nice and gullible. However, even the wise guy may be taken in, particularly in the field of optical illusions, and we shall reach into our collection of these nifties from time to time for your visual amusement and surprise.

Did you ever see anyone who had a finger with a nail on each end? Unusual, eh? Not at all: *everyone* has such a finger! To find yours, proceed as follows:

Gaze out of a window and focus on some distant object. Without changing this focus of the eyes, raise both arms horizontally so that the hands are on a level with the eyes, both fists closed, the two index fingers extended toward one another. The backs of the hands should be up, so that the two index fingernails are up, horizontal, and touching each other, held about one foot or somewhat less in front of the eyes. When the two fingers are now pulled apart from one-half to one inch, an isolated section of finger with a nail on each end will be seen, floating in space between the two separated digits. The only requirement for seeing this illusion with ease is the ability to hold the focus on a distant object, or to gaze dreamily off into space with the well-known vacant stare, instead of shifting the focus to the nearby fingers as is, of course, the natural automatic tendency.

With a bit of practice it is easy to place the hands before the face so as instantly to see the third finger, at any time or place. The thumbs look even funnier, and three or four floating fingers may be observed at one time if all the fingers are used in this same manner, simultaneously. Touch the points of two pencils together, then pull them apart to see a piece of pencil with a lead on each end. Two matches will yield a match with a head on each end. Many other slender objects can be used, but none approaches the floating finger as a startling, realistic impossibility.

LABELON TAPE

THE Minnesota Mining and Manufacturing Company, of Saint Paul, has produced a variant of their Scotch tape that is a boon to all laboratories and all persons who may need to label bottles, jars, boxes, or other containers. A blue writing surface is sandwiched between two layers of acetate. When the top layer is written upon with pencil or stylus the impression is made on the blue base and shows through strongly; it is indelible and cannot be smudged, soiled, or obliterated. We used a mimeograph stencil stylus with excellent results, although an ordinary pencil is as good as anything. The roll comes in a plastic dispenser with cutting edge and consists of 400 inches of ¾″ heavy tape. Tear off a suitable length, fasten to container just as you would any Scotch tape, then write on it; or place on platen of typewriter, type the label, then fasten to container. The tape will not curl or yellow with age. Order from A. S. Aloe Company, 5655 Kingsbury, St. Louis 12, Mo., or 492 Peachtree St., N. E., Atlanta 3, Ga. $1.85 per roll.

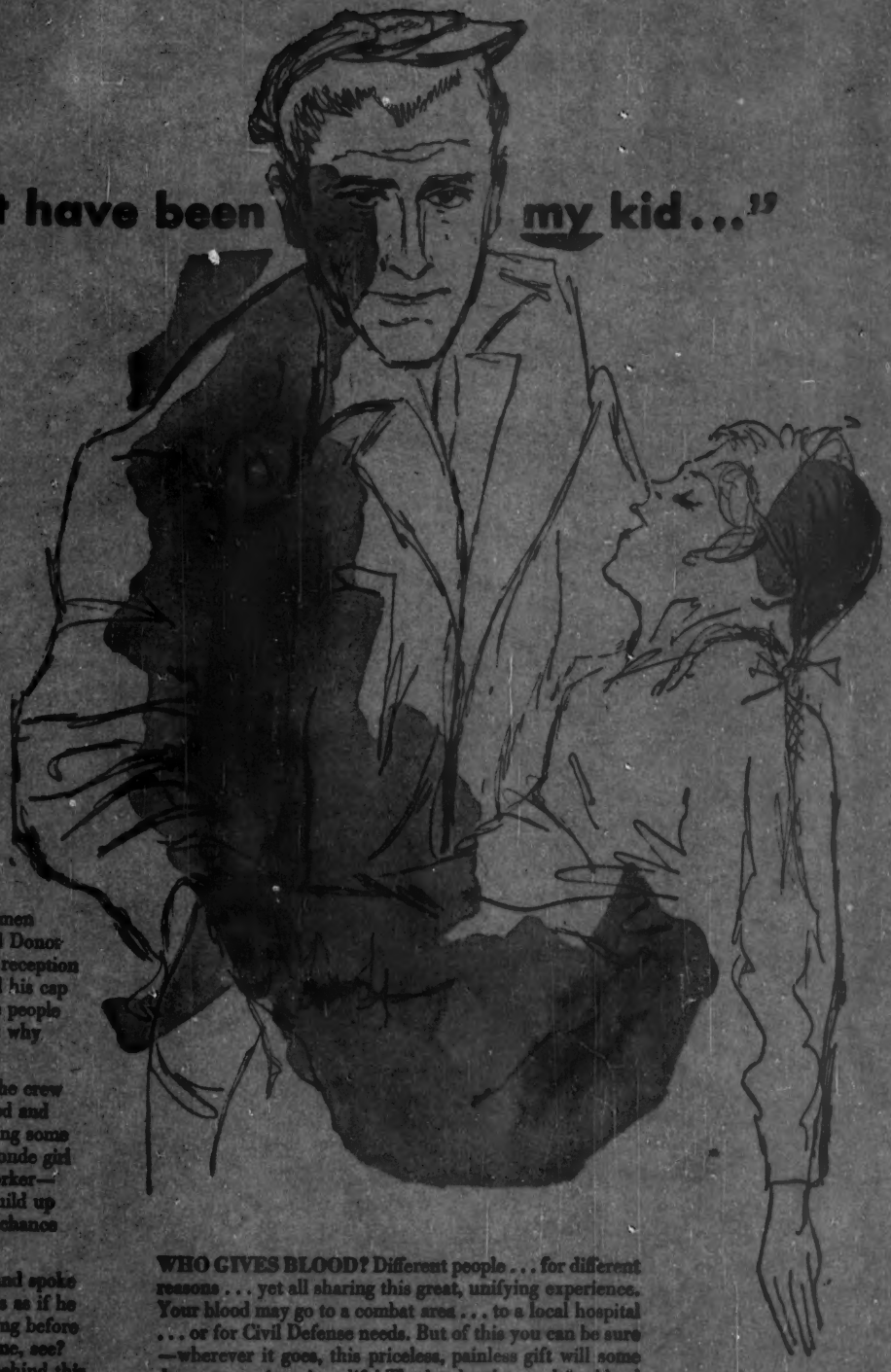
POSTMOR TEMQUOTES

Macaulay:

Lars Porsena of Clusium
By the Nine Profs he swore
That Soph Premedicos should use
His microtome no more.
By the Nine Profs he swore it,
And hid it safe away,
But the red-head Coed dug it out
And up and down and round about
She cranked until the gears wore out
And nicked the razor manifold,
In the brave days of old.

—*Horatius.*

"she might have been my kid..."



The line of men and women waiting to register at the Blood Donor Center moved briskly past the reception desk. The truck driver fingered his cap nervously as he listened to the people behind him. They talked about why they had come to give blood.

He heard the young kid with the crew haircut say he was being drafted and figured he might soon be needing some blood himself. He heard the blonde girl say she was a Civil Defense worker—and how it was important to build up our blood reserves against the chance of a sudden air attack here.

Then the truck driver turned and spoke . . . the words coming in spurts as if he were describing a picture moving before his eyes . . . "There was no time, see? She comes running out from behind this parked car right under my wheels. She's wearing pigtails, and the way the sun is shining on her hair, she might have been *my* kid. I bring her to the hospital . . . and it takes 3 pints of blood before she opens her eyes . . .

"I'm here now," the truck driver added, "to make my first installment on those three pints of blood!"

WHO GIVES BLOOD? Different people . . . for different reasons . . . yet all sharing this great, unifying experience. Your blood may go to a combat area . . . to a local hospital . . . or for Civil Defense needs. But of this you can be sure —wherever it goes, this priceless, painless gift will some day save an American life! That's why the need for blood is *always* urgent!

Give Blood Now

CALL YOUR RED CROSS TODAY!

NATIONAL BLOOD PROGRAM

Cancer strikes 1 in 5

Strike back

Give

Your gifts to the American Cancer Society help guard those you love.

Your dollars support research in a hundred laboratories and universities . . . spread life-saving information . . . ease pain and suffering . . . provide facilities for treatment and care of cancer patients.

It is a sobering fact that cancer may strike anyone tomorrow: strike back today with a gift to the American Cancer Society. You may mail it, simply addressed CANCER, c/o your local post office.

American Cancer Society